DESIGN, CONSTRUCTION, OPERATION OF METAL-WORKING AND ALLIED EQUIPMENT

# MACHINERY

JUNE, 1943

The supreme importance of the aircraft industry in the winning of the war is so generally recognized that the methods and achievements of this industry cannot be over-emphasized. July MACHINERY will feature the most recent advances in the building of aircraft, giving details of the practice of many plants throughout the country. Many of the methods described are applicable in other fields, giving these articles a broad general significance.

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Number 10

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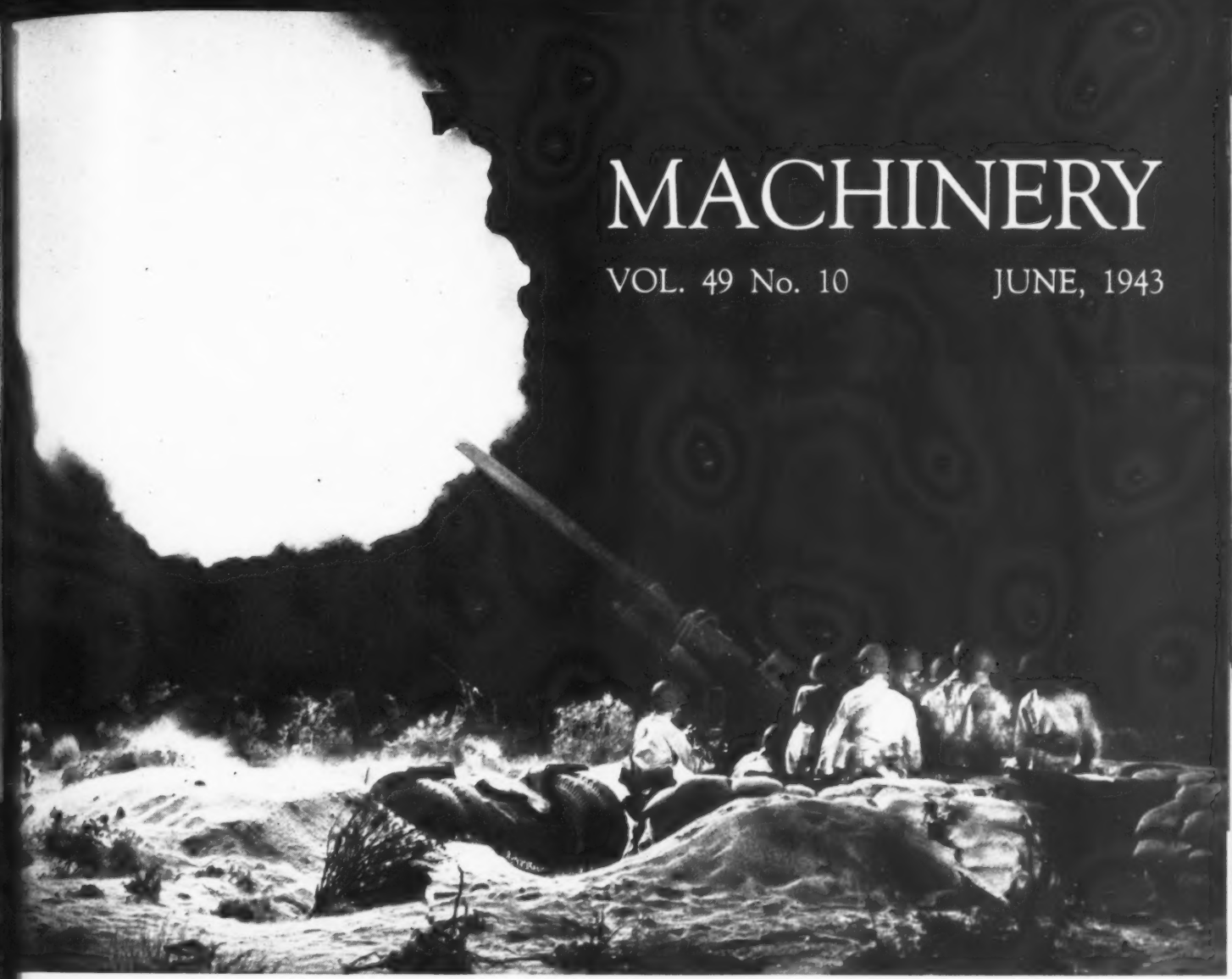


Photo U. S. Signal Corps

# Building the Mounts for 90-mm. Anti-Aircraft Guns

## Another Instance where an Industrial Concern Delivered Quantities of Important Ordnance Materiel Far in Advance of the Scheduled Date

By CHARLES O. HERB

ONE of the outstanding ordnance developments in this war is the 90-millimeter anti-aircraft gun, which has an effective range of over thirty thousand feet and can, therefore, shoot down bombers six miles in the air. The gun shoots an explosive shell, can be fired by remote control, can be quickly transported from location to location, and can be set up within a few minutes, ready for action. Guns similar to this type have proved especially effective in protecting British cities against air raids and in Far East fighting.

Soon after the disaster at Pearl Harbor, contracts were let to the Fisher Body Division of the General Motors Corporation for large quantities of mounts for 90-millimeter guns. The schedule called for delivery of the first mount by the fall of 1942. By the application of manufacturing techniques developed through years of automotive production, this concern was able

to turn out finished mounts five months ahead of schedule, and only four months after starting to equip plants for this work. As a matter of fact, many hundreds of gun mounts were delivered to the Government ahead of the date originally set.

To facilitate manufacture on a large scale, the gun mount production was divided among four plants in the Fisher Body Division of General Motors Corporation. The large amount of welding—25,000 linear feet on each mount—is performed at three of the plants, machining of the various details at three plants, and final assembly at one plant. Component parts are welded and machined in special fixtures that insure complete interchangeability in the shop and in the field. Some assembly operations are performed along moving conveyor lines.

Two difficult problems were involved in planning mass production of these gun mounts. First, it was impossible to obtain a sufficient number of horizontal boring, drilling, and milling machines from regular machine tool builders. The Fisher Body Division solved this problem by building, itself, a considerable number of heavy-duty machines of this type to meet the needs of specific operations. The second problem was to train employes to perform operations with which they were entirely unfamiliar. Men who formerly operated paint spray guns, punch presses, etc., had to be trained to run machine tools that must turn out work of close accuracy. Even men who were experienced welders had to be taught a new technique for producing gun mount weldments. That these difficulties were overcome in short order redounds greatly to the credit of this automotive concern.

To emphasize the manufacturing accuracy required, it is only necessary to point out that a variation of 0.001 inch in a dimension on one detail of the gun mount will cause projectiles fired from the gun to miss their objective by more than 60 feet at a specific range. Such a variation would cause rejection of the gun by Army Ordnance inspectors.

Much of the welding on the larger parts as, for example, the trail or tongue and the outriggers, is performed in the Lansing plant of the concern. Fig. 2 shows table-like fixtures used for holding the trail pieces in true relation to each other during welding. The fixtures are mounted on Ransome positioners, which can be tilted and revolved to enable all welding to be done in a horizontal plane. The fabrication of the trails is completed in fixtures of the design shown in Fig. 3, which are mounted on positioners that can be rotated on a horizontal axis. Four men customarily work at one fixture.

*Fig. 1. Impressive Array of Powerful Anti-aircraft Guns on the Final Assembly Floor of a Fisher Body Plant*

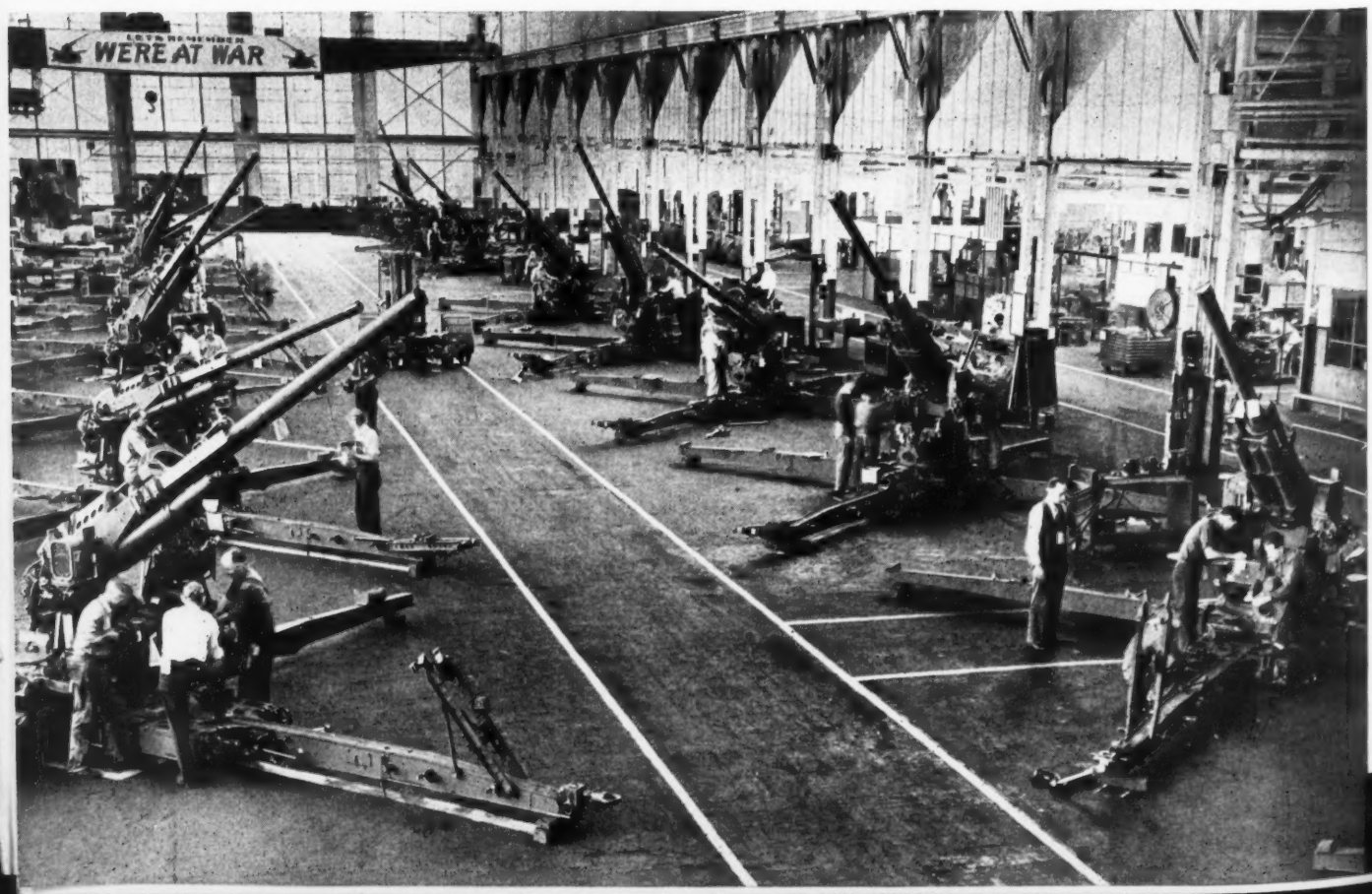


*Fig. 2. The Welding of the Trail or Tongue for 90-millimeter Anti-aircraft Gun Mounts is Facilitated by the Use of Fixtures Mounted on Welding Positioners*

*Fig. 3. Final Welding Operations on a Trail are Performed in a Jig Mounted on Trunnions, which Enables All Welding to be Done in a Horizontal Plane*

Unionmelt welding is employed in attaching the base rings to the baseplates, such an operation being illustrated in Fig. 4. The work is held on a fixture mounted on a Ransome positioner, and is slowly revolved during the operation. Welding is performed by a head mounted on an arm extension which is attached to a trolley running on overhead tracks. Flux to cover the welding electrode is fed from a hopper on this head. The arm extension can be conveniently adjusted for height. This method of welding is employed both around the inside and outside of the ring, and is performed in the Detroit plant of the Fisher Body Division.

Punch presses equipped with permanent steel dies are used extensively for cutting steel plate up to 1/4 inch thick to irregular and circular outlines, ready for welding operations. This method has proved economical, as detail parts can be cut out at fast production rates and within close limits.

However, oxy-acetylene cutting machines are employed in some instances for this work, especially on heavy material. In Fig. 5, a large machine of this type, built by the National Cylinder Gas Co., is seen engaged in cutting four pieces at a time from plate 1 inch in thickness. A hole is cut out first for the center of each piece, after which the irregular outline is cut. The torches are guided from a templet on a table at the extreme left, the machine being provided with a rail or beam, about 20 feet long, which supports the cutting torches on the right-hand end and the tracer head on the left-hand end. This particular machine is installed in the Fleetwood plant of the Fisher Body Division.

Machining operations in the Pontiac plant will now be described, this plant being equipped with a large number of special machines. In Fig. 6, for example, is illustrated a Morton machine equipped with three cutter-heads for milling one end of outer outriggers. Cutters on two vertical-spindle heads mill pads on the top and bottom sides of the outriggers, while a cutter on a horizontal-spindle head faces an end surface. Six outriggers can be mounted on the stationary table at one time, the practice being to set up three outriggers while three others are being milled. The cutter-heads are mounted on a column which moves along a bed past the work. Dimensions are held within a tolerance of plus or minus 0.005 inch.

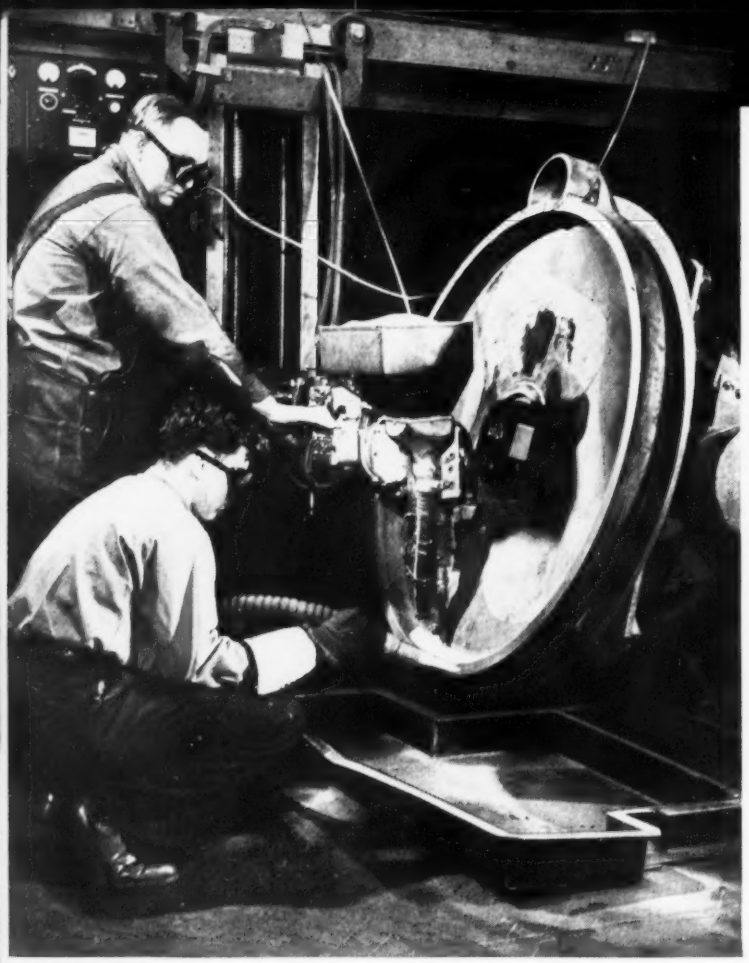


*Fig. 4. The Large Base Ring is Welded to the Top of the Base, Both Inside and Outside, by the Unionmelt Process*

The front ends of the outriggers are brought up solidly against locating blocks by tightening screws to adjust the fingers that are seen at the back ends of the outriggers. Hardened and ground blocks permanently attached to the fixtures facilitate setting the cutters to the proper cutting depth.

The next operation on the outer outriggers is performed by a machine of the type shown in Fig. 7, which is provided with two Fray universal milling heads at one end, as seen in the foreground, and with a two-spindle Natco drilling unit at the opposite end. The milling heads finish narrow pads on opposite sides of the outriggers as the carriage on which they are mounted is fed along the work. Accuracy of the dimension between the two pads (5 inches within plus or minus 0.005 inch) is attained by setting the end-mills against hardened and ground locating or gage blocks in the manner shown. The milling heads are mounted on cross-slides so that they can be adjusted in and out relative to the work to suit the cutter lengths. The Natco unit is employed for drilling and reaming the locking key slot and the hinge pin holes while the milling operation is in progress.

A considerable portion of this machine was built up from salvaged equipment. For example, a hydraulic unit formerly incorporated in a spot-welder provides the pressure for actuating the milling carriage and the drilling and reaming unit.

On the main outriggers, it is necessary to mill three pads accurately at right angles to each other on one end, as indicated in Fig. 8. This operation is performed on another Morton machine of stationary table design, having a moving column to feed the cutters along the work. Again, three outriggers are milled while three

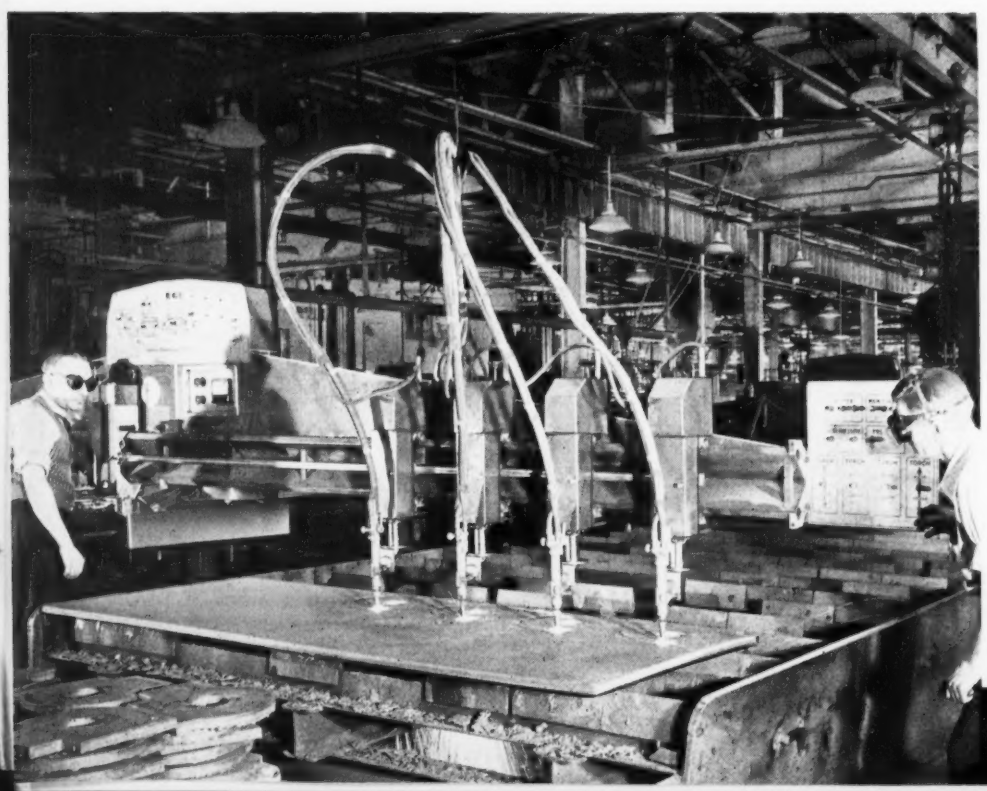


*Fig. 5. Machine Used for Simultaneously Cutting out Four Detail Pieces from Plate 1 Inch Thick for Fabrication into Gun Mount Sections*

*Fig. 6. Milling Machine Employed for Finishing Pads on the Top and Bottom of Outer Outriggers and for Simultaneously Milling a Surface at Right Angles to the Other Two Surfaces*

others are being set up. The column is fed from left to right or vice versa, depending upon which end of the table holds the work being milled. Four cutters 14 inches in diameter, with thirty tool bits each, are employed.

There is a setting-up bar on each fixture that fits the yoke-like end of the outriggers when it is swung up into a horizontal position for locating purposes. A gage-block permanently fastened to the fixtures is used in checking the accuracy of the operation. The nominal width of the slot being milled is 5 inches, and a total tolerance of 0.010 inch is allowed, but the operation is normally performed to a considerably closer tolerance.

Two flat surfaces of considerable size are milled accurately with respect to a flat bearing on the gun mount pedestal by the Morton machine illustrated in Fig. 10. These pads are finished to receive jacks. The cutter-heads are adjustably mounted on vertical slides. These slides are attached to rams that can be moved in and out and also crosswise to feed the cutters over the complete area of the surfaces being milled. The accuracy of the cuts is determined by applying the gage-bar that is seen lying across the pedestal bearing, in combination with a flush gage which is inserted through holes in the bar.

In this milling operation, as in practically all others in this plant, unusual care must be taken in setting up the work, because it is constructed

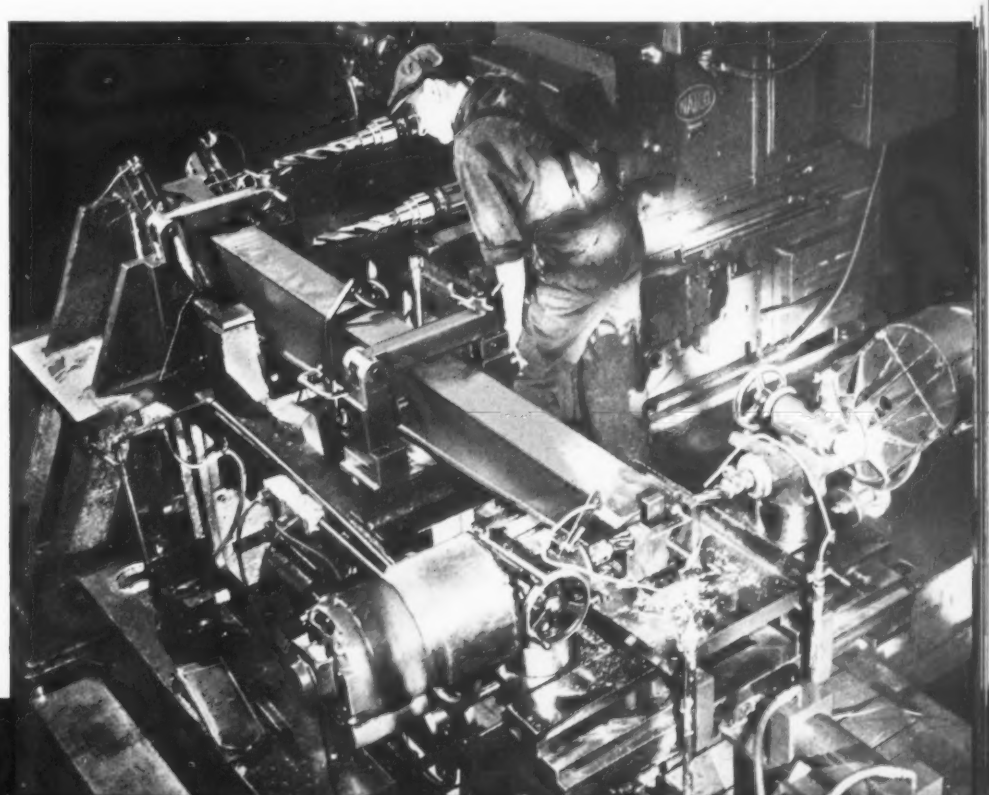


*Fig. 7. Milling, Drilling, and Reaming Opposite Ends of Outer Outriggers with Universal Milling Heads and a Hydraulic Drilling Unit*

*Fig. 8. High-production Milling Operation on Main Outriggers, in which Four Cutters Mill Three Surfaces at Right Angles to Each Other*

of comparatively thin plates, welded together, and inaccuracies due to distortion are likely to occur. In loading the work, hydraulic jacks incorporated in the machine raise the weldment up against a gage-block. The milling cutters are about 8 inches in diameter.

Prior to this operation the pedestal bearing was bored and faced on a machine built by the Fisher Body Division, which is illustrated in Fig. 9. When a pedestal comes to the plant, it has a scribed line running up the center of the trail extension, this line having been put on by checkers at the Lansing plant. In loading the pedestal into the boring and facing machine, this scribed line is centered with the hinged pointer seen in the far background. A circle that was previously scribed around the bearing is also referred to in setting up.

Facing cuts are taken by two cutters on a slide that is fed radially on top of a revolving column in the center of the machine. A separate tool-head, also mounted on the central column, finishes a series of eight narrow pads around the inside of the large opening. These finished pads are later used for gaging purposes. The weldment is located in this machine from pads that were welded to it at the Lansing plant after the part had been normalized to relieve strains, and the same pads are used for accurate set-up in other operations on the part. On the right-hand side of the machine as seen in the illustration is a swinging bar with a flush

*Fig. 9. Preliminary Operation on Gun Pedestal Weldment, in which Bearing is Faced and Pads around the Bore Machined Accurately*

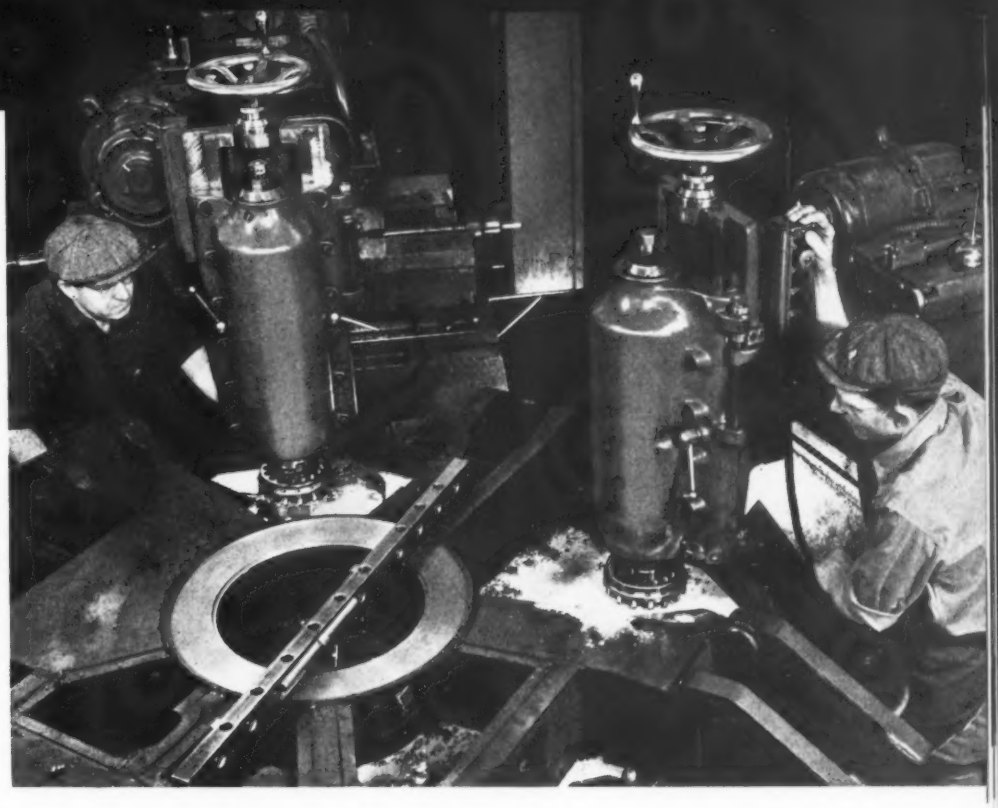


*Fig. 10. Machine Used for Finishing Flat Surfaces of Considerable Area in Close Relation as to Height with a Flat Bearing Surface*

pin, which is used in checking the finished face of the pedestal bearing for height in the manner shown.

The four-unit Natco machine shown in Fig. 11 produces, in all, eleven holes to center distances on which a total tolerance of only 0.010 inch is allowed. Two units with double spindles drill outrigger hinge holes and start a hole that is later broached for the locking key. Another unit with one spindle drills the trail hitch hole, and a fourth unit drills four holes for the fuse setter bracket. All top holes are also reamed, the spindles being equipped with quick-change chucks to facilitate substitution of tools.

A machine of very unusual design was built for milling eight bosses on the inside of the trail. This machine, as seen in Fig. 12, is provided with a special tool-head having four cutters, about 4 inches in diameter each. The tool-head is mounted on the front end of a ram which is advanced a distance of about 8 inches into the trail to mill the bosses accurately at right angles to axle holes that are at a center distance of 41 inches from the first boss. The axle holes are drilled and reamed on opposite sides of the trail in the same set-up, one of the reamers being seen in the foreground. While these cuts are in progress, two other units perform operations on the opposite end of the trail.

A large Fisher boring, drilling, and milling machine constructed especially for contour-milling two bogie pads on a trail is shown in Fig. 13.

*Fig. 11. High-production Drilling Operation on the Gun Pedestal, in which Four Hydraulic Units are Employed at the Same Time*

*Fig. 12. Ingenious Tooling Employed for Finishing Bosses that are Completely Enclosed in the Trail*

The moving table carries the trail beneath form cutters mounted on a spindle that is supported by a heavy bracket attached to the machine column. The latter, of course, remains stationary. One of the bogie pads is of convex outline, while the other consists of a shallow slot with tapered sides. Two Kingsbury heads spot-face bosses on the opposite end of the trail while the milling operation is in progress. This constitutes another example of the combining of operations in one set-up.

Two of the most important members of gun mounts are the leveling socket and its mating spherical bearing. The machining of these members must be closely controlled, and after they have been produced within a close tolerance, they are carefully lapped together. The spherical cavity in the socket is turned on Bullard vertical turret lathes set up as illustrated in Fig. 14. Identical tooling is employed for roughing and finishing, but the tool-head of the finishing machine is doweled to the cross-rail, so that it is always in the exact center of the table. With this provision, the accuracy of the operation is not dependent upon the more or less unskilled operator. The tool-head is of a swiveling design, and is so constructed that the cutter can be fed at the required radius as the work revolves. The swiveling mechanism is actuated from a drive that receives power from the right-hand side of the vertical turret lathe.

A short rod projects from the center of the

*Fig. 13. Milling Machine Built Especially by the Fisher Body Division for Contour-milling Pads on One End of the Gun Mount Trail*

*Fig. 14. Special Tooling Used for Boring Spherical Seat in Leveling Sockets Accurately to Specified Radius*

cutter-head on which a crank-like gage is mounted to check the distance from this point to the cutting edge of the tungsten-carbide tipped tool. There is also a hardened and ground block on one side of the cutter-head for approximately positioning the tool bit. The illustration shows the cutter-head raised from the operating position.

The bronze bearing which fits the leveling socket is also machined on a Bullard vertical turret lathe, equipped in the manner shown in Fig. 15. Both the inside and outside of this part are turned spherically, the tool that is seen mounted on the head being employed for taking the internal cuts. The opening at the top of the sphere is also bored in the same operation.

In both external and internal machining, the correct curvature is obtained as the tool-head is fed around a semicircular way on a special casting attached to the front of the regular turret ram. The ram slide is permanently doweled to the cross-rail, central with the table. The care taken in turning the spherical surfaces of the bearing and socket has resulted in a reduction in the lapping time on these parts of at least 75 per cent over previous methods. From 0.004 to 0.006 inch of stock is left for removal by lapping.

Lapping of the socket and bearing is performed in machines of the type shown in Fig. 16. Before the parts are released from this operation, they must pass an inspection for closeness

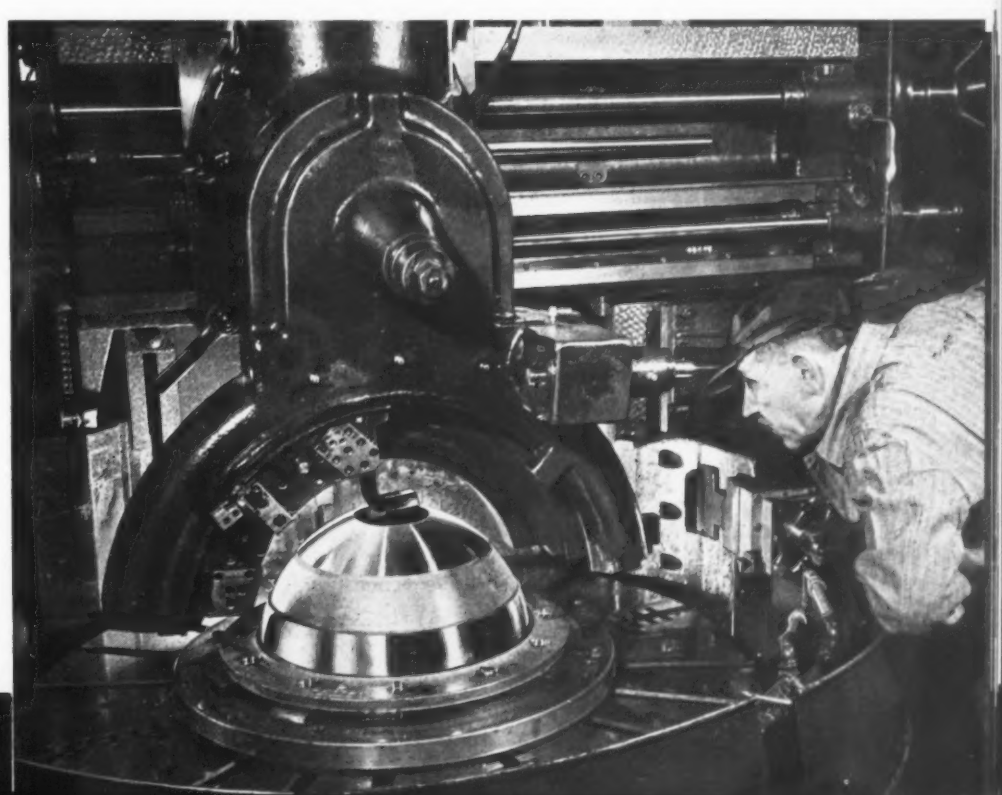


*Fig. 15. Tooling Used on Another Vertical Turret Lathe for Turning the Bronze Leveling Socket Bearing both Internally and Externally*

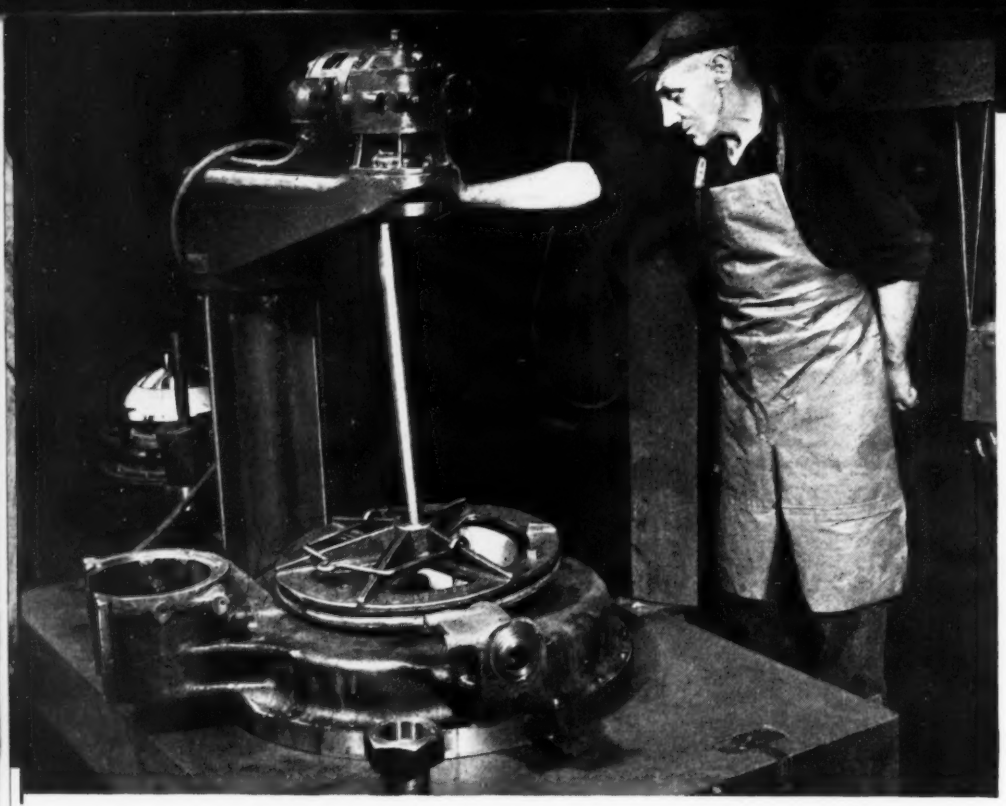


*Fig. 16. A Very Close Fit and High Finish are Obtained on the Leveling Socket and Bearing by Lapping Machines, which Impart a Wabbling Action to Bearing*

of fit of the socket and bearing. In this inspection, chalk lines are drawn in the leveling socket, and then, when the bronze bearing is revolved in the socket, it must completely wipe away all chalk marks. Similar chalk marks are then placed on the bronze bearing to see if they will become obliterated when the bearing is turned in the socket.

These lapping machines are designed to impart an eccentric motion to the upper end of a rod connected to a head that is attached to the bronze bearing. Thus, as the machine is operated, a wabbling motion is imparted to the bearing. In lapping, a mixture of Carborundum and oil is used as an abrasive. Two grades of Carborundum, a coarse and then a fine, impart a high finish. When the parts leave the machine, the radius of the mating surfaces must be within plus nothing minus 0.0005 inch.

A Fisher-built horizontal boring mill is shown in Fig. 17 being used for operations on the "pot" of leveling sockets. This machine also is provided with a fixture that enables a socket to be loaded, ready for machining, while work is in progress on another socket. The operation consists of facing the top of the pot, drilling a hole in the center, boring the hole, counterboring the top pot surface, rough-machining a depression around an inside boss, and rough-milling clearance around the large opening. Hardened and ground blocks on the fixture aid in setting the tools to correct heights

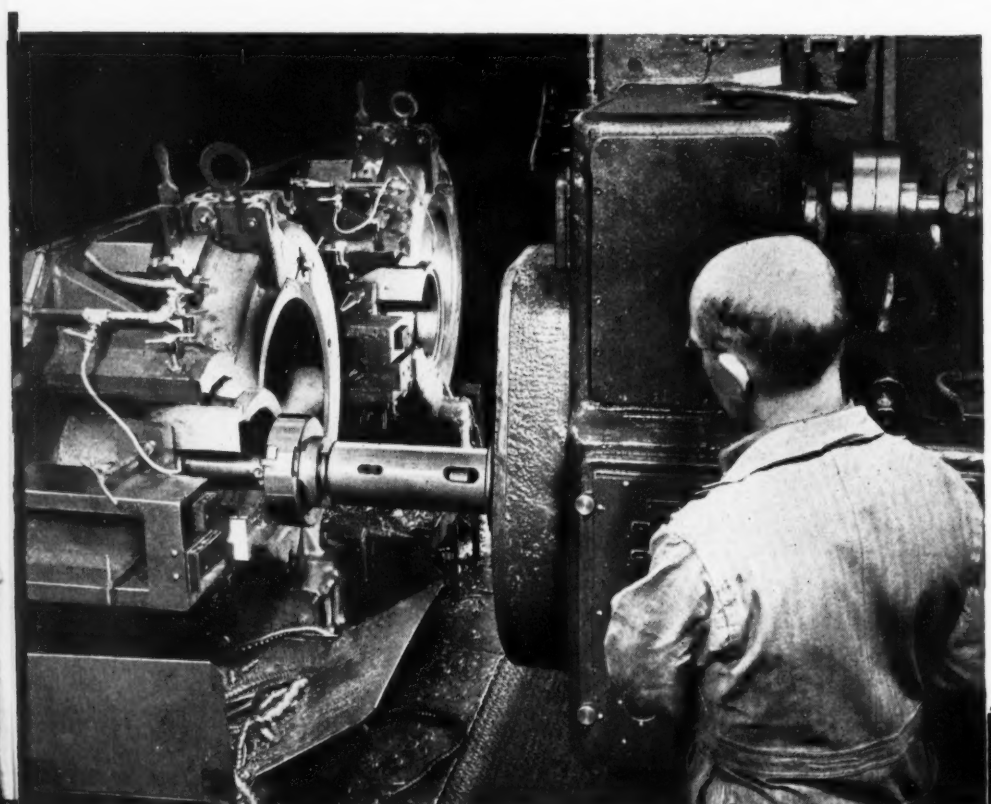


*Fig. 17. A Fisher-built Horizontal Boring Mill Employed for Taking a Series of Cuts on the "Pot" of Leveling Socket Castings*

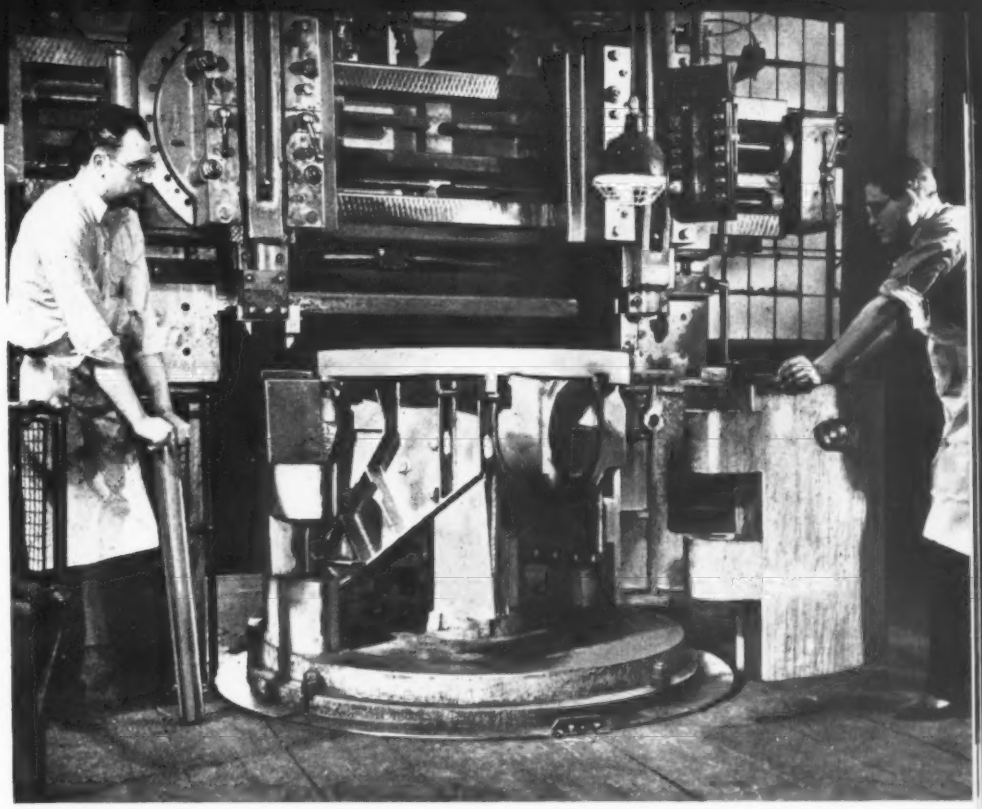


*Fig. 18. Vertical Boring Mill Operation on the Gun Base. The Fixture Used is Made with a Hinged Section to Facilitate Loading and Unloading*

and in gaging the work while it is still in the fixture. Indicator gages are employed to check certain dimensions—specifically, the all-important counterbore diameter.

An important precaution that insures accurate work in this plant is the use of master checking fixtures for inspecting all major parts and even some small pieces after they have been completely machined. There are, for example, inspection fixtures for the pedestal, outriggers, and trail.

A Morton vertical boring mill primarily designed for operations on the gun base is shown in Fig. 18 in operation in the Ternstedt plant. A feature of this operation is the use of a heavy, box type fixture, one side of which is hinged for easy loading and unloading. With the work in place, the swinging section is closed, and a heavy pin, such as seen in the hands of the operator at the left, is inserted through lugs in the stationary and hinged members to lock them securely together. In the operation on this machine, the base weldment is bored, counterbored, faced, etc. One of the counterbores must be held to size within plus nothing, minus 0.002 inch, and all diameters must be concentric within 0.0025 inch. A central hole must be closely concentric with the large counterbore.

An unusual set-up for a shaper is illustrated in Fig. 19. The operation consists of machining three-sided hook guides on both sides of a bogie frame weldment. A special device on the ram,

*Fig. 19. Hydraulic Shaper Equipped with Special Device on Ram for Simultaneous Machining of Hook Guides on Both Sides of Bogie Frames*

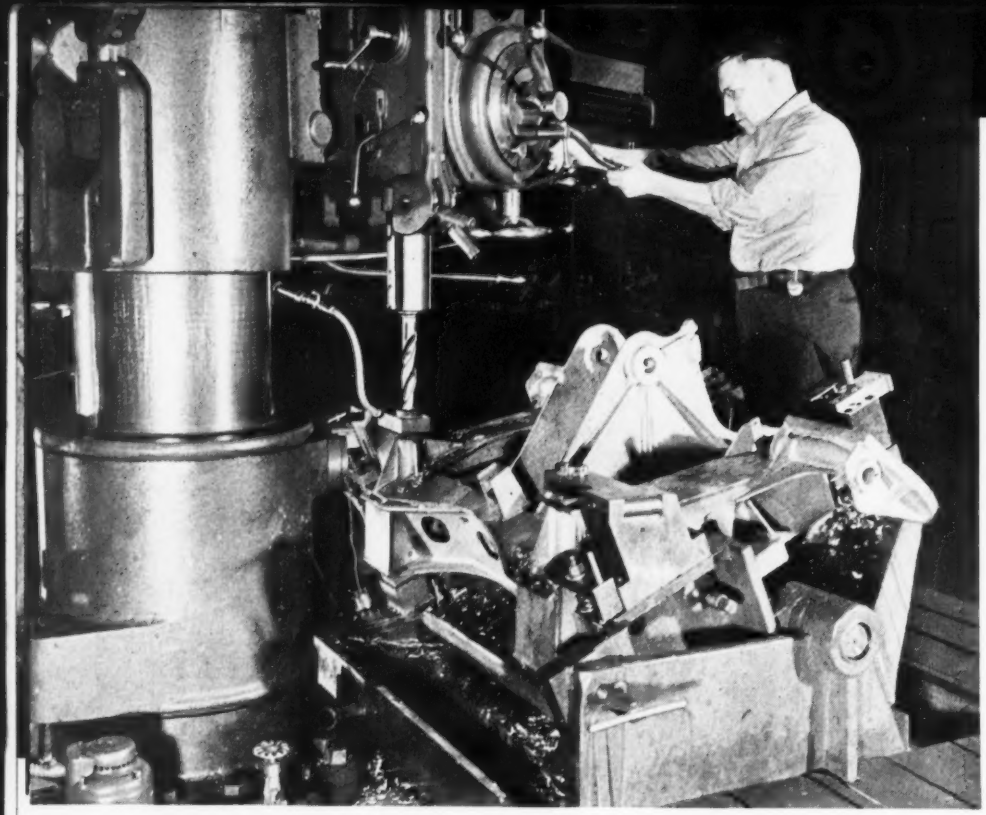
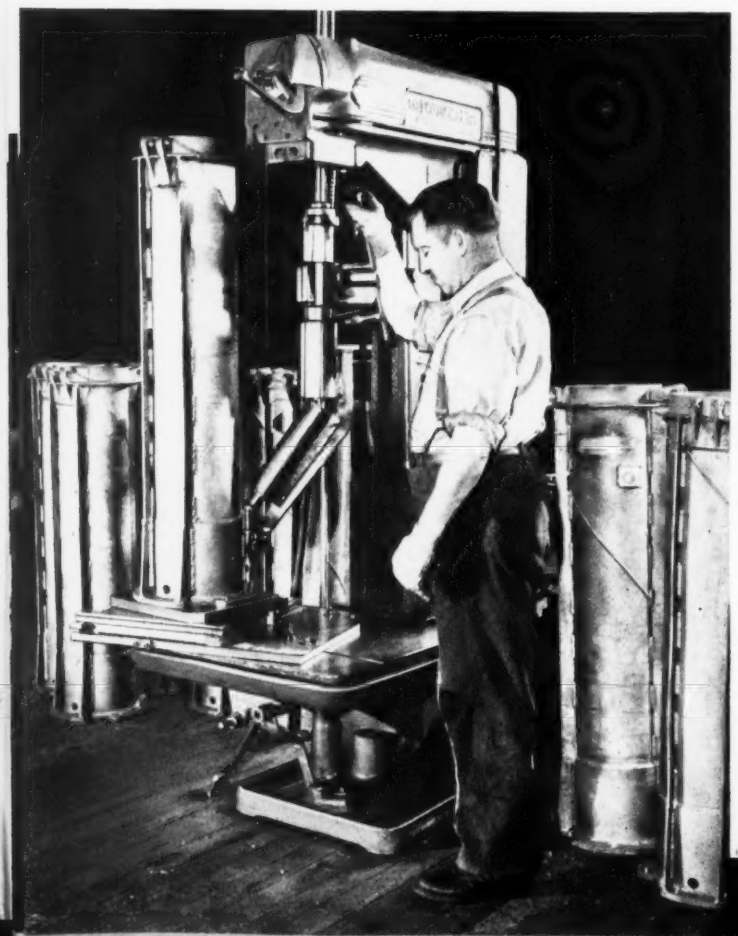


*Fig. 20. Fixture of Tilting Design Used in Combination with a Radial Drilling Machine for a Series of Operations on a Bogie Frame*

which is provided with two tool-bars, enables both guides to be shaped at the same time. The tool-holders are not adjustable, and so they are always in proper relation to each other and to the fixture. With this arrangement, accuracy is not dependent upon the skill of the operator.

At the time that the photograph was taken, tool bits were projecting from both sides of the bars for machining the sides of each hook guide. When these cuts were completed, tool-holders were substituted that had a cutter bit on the under side only for machining the bottom pad of the guides. The cutters are fed vertically by operating a large handwheel, while the work-table is fed horizontally in the usual manner. The fixture slides with the table. Guides for protecting the operator were removed from the machine at the time that the picture was taken to give a clear view of the tooling. The machine is a Rockford hydraulic shaper.



The use of a tilting jig to enable holes to be machined on a bogie frame in two different planes is illustrated in Fig. 20. With the jig tilted forward, eight journal bolt-holes are drilled; 1/8-inch oil-fitting holes are drilled and tapped; trail slot holes are drilled, ready for milling into slots; and finally, the journal bolt-holes are spot-faced with a 3 1/2-inch diameter spherical tool.

The jig is then swung back 24 degrees into the position shown for drilling two hook guide holes and spot-facing these holes with 3-inch spherical cutters. Pads welded on the work especially for the purpose are used for locating the weldment in this and other operations. These pads are chiseled off after the bogie frames have been completely machined. Hinged and sliding bushing plates are used. The machine is a Fosdick radial drill.

*Fig. 21. Special Device Designed for Use on a Single-spindle Drilling Machine for the Rapid Facing of Holes on the Back Side of the Flange of Counterpoise Tubes*

A unique method devised for spot-facing the top side of a series of eight holes in the flange of counterpoise tubes is shown in Fig. 21. The long counterpoise tube is placed on the indexing base of a fixture mounted on the table of a Fosdick single-spindle drilling machine. Then, by means of a special universal-joint drive provided with a spindle at the lower end that is only slightly larger in diameter than the cutter, the holes can be spot-faced from above. This practice greatly expedites the operation, as it avoids the frequent removal and attachment of cutters that would be necessary if the holes were back spot-faced in the usual way.

Sub-assembly and final assembly operations on the gun mounts are all performed in one plant. Some sub-assembly operations are performed along moving conveyors. Final assembly and inspection of the mounts with guns in place are performed in the large bay in Fig. 1.

# Specially Equipped Comparator Speeds Inspection of Aircraft Radio Part

PRODUCTION of a vital aircraft part has been stepped up 20 per cent and its cost cut one-tenth at the Mansfield, Ohio, plant of the Westinghouse Electric & Mfg. Co. through the use of specially equipped inspection comparators of the type shown in the accompanying illustration. Previous to the introduction of these comparators, the women inspectors complained of headaches and eye strain, from which some relief was obtained by employing powerful magnifying glasses.

With the adoption of the new inspection equipment, the eye strain and headaches disappeared, and the records showed that 20 per cent more commutators were passing through the inspection lines daily. Also, the number of rejected assembled units coming from the production lines was reduced from 30 per cent to less than 3 per cent.

The acorn-sized commutator of a dynamotor that supplies power for aircraft radio sets must be inspected to insure that the paper-thin strips of copper and mica are parallel and in accurate alignment in the commutator, since a strip located at an angle is likely to create static, which would interfere with the radio reception in a plane. The thin strips range from 0.018 to 0.050 inch in thickness.

With the specially equipped comparators, the image of a commutator surface is reflected on a glass screen, magnified twenty-two times its normal size. With this magnification, a more accurate inspection can be easily made. Use of the comparator for this inspection work was made possible only through a development of the quality control laboratory engineers of the Westinghouse company. This development involves the use of a concave mirror, which reflects the light back on the commutator in such a manner that a perfect image of the cylindrical surface is magnified over twenty times on the comparator screen. The comparator itself is a commercially available product of a well-known company.

*Inspecting Commutators for Aircraft Radio Dynamotors by Means of Specially Equipped Comparators that Magnify the Image of the Commutator Surface Twenty Times*

# Small-Arms Ammunition from

## The Manufacturing Technique Followed at the Denver Ordnance Plant in Producing Jackets and Primers for Caliber 0.30 Cartridges and in Assembling and Inspecting the Cartridges—Second of Two Articles

By CHARLES O. HERB

STEP-BY-STEP operations in the production of cartridge cases for caliber 0.30 cartridges in the plant of the Remington Arms Co., Inc., at Denver, Colo., were described in a comprehensive article published in April MACHINERY. This, the concluding, installment will deal with the manufacture of the bullet jackets and the primers; the assembly of the bullets and of the complete cartridges; and the automatic weighing and inspection of the finished cartridges.

### *Producing the Gilding-Metal Jackets*

Jackets for the cartridges are manufactured by a separate line of machines adjacent to the area in which the cases are produced. The jackets are made from gilding-metal cups which have gone through one press operation. The cups have been thoroughly washed and dried when received at the plant, so that they can be fed directly into the hoppers of the presses employed for the first drawing operation. This operation is performed on Bliss machines of the type illustrated in Fig. 27, which is constructed with two rams on opposite sides of the machine. The cups are fed from an overhead hopper and pass through glass covered troughs with the open end upward to a feeding device which carries them individually to the dies. There are two sets of punches and dies on both sides of the machine. Upon the completion of this operation, the jackets are washed and water-polished in tumbling barrels arranged as illustrated in Fig. 28.

The jackets are next fed through Bliss presses set up as shown in Fig. 30 for the second draw. These machines are of a single-ram design, and are fitted with two punches and dies for drawing two jackets at a time. Third and fourth draws

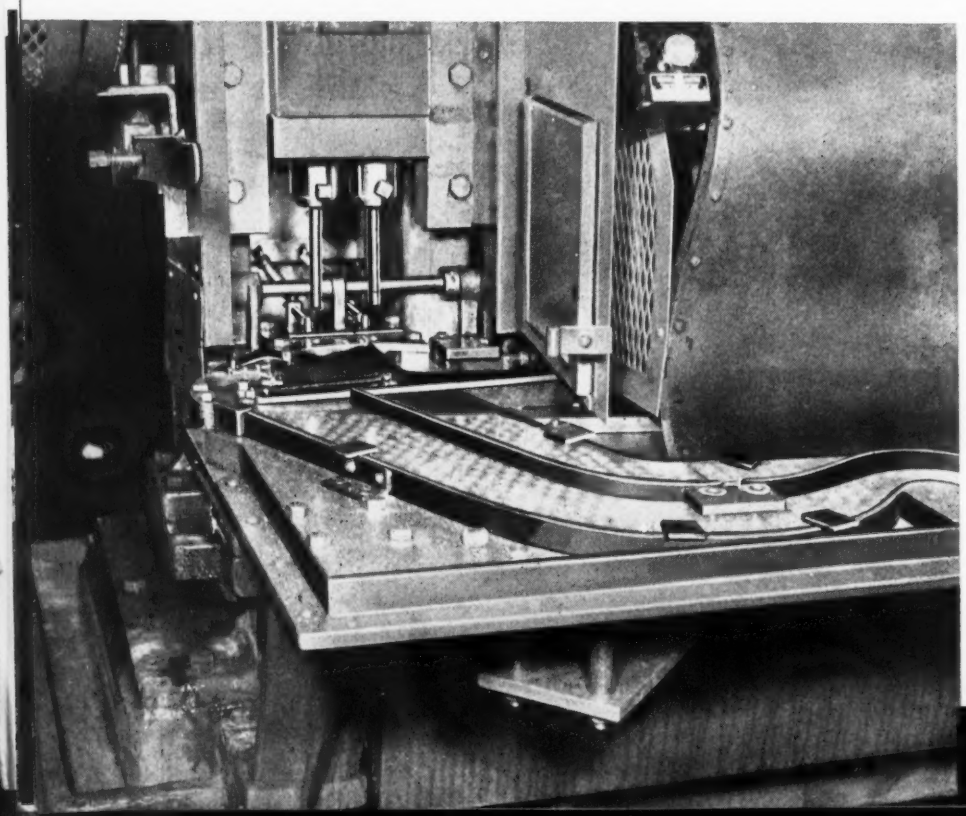


*Fig. 27. One Side of a Double-ram Press in which the Cups for Bullet Jackets are Given Their First Draw*

are performed on machines of the same type. A washing and water-polishing operation follows each of these draws.

The jackets are next trimmed to the desired length in Fidelity machines of a horizontal design, which employ a circular tool that cuts off the open end of the jacket and a single-point tool that removes all burrs from the severed end. After another washing and drying operation, the jackets are fed to bullet assembly machines. The various steps in jacket manufacture are illustrated diagrammatically in Fig. 29. The procedure is the same with jackets for different types of cartridges, but the diameters and lengths vary somewhat, depending on whether the jacket is for an armor-piercing, ball, or tracer cartridge.

### *Assembling the Cores and Jackets*

The operation of the bullet assembling machines differs slightly according to the type of bullet being handled. Fig. 31 shows a machine engaged in assembling armor-piercing bullets. This machine is of Waterbury-Farrel design, but was built by the Heidrich Tool & Die Corporation, Detroit, Mich. Cartridge cases are fed from a tube to a station at the left-hand end of the machine and are then indexed successively by a transfer slide to fourteen other stations. In the first station, the jacket is inserted automatically into the transfer bar with the open end upward. The machine will stop if a jacket is too long or is fed with the closed end up or if the mechanism should fail to feed a jacket.

Then, in succession, the jacket is pointed, the lead point core is inserted and seated, the steel core is inserted and seated, the heel cap or base is inserted and seated, the end of the jacket is "coned" to retain the cores and fillers, the base of the bullet is formed to the final shape, and the bullet is sized to establish the specified diameter with accuracy. That the mechanism on these assembly machines is rather complicated will be apparent from Fig. 32, which shows the rear view of a machine and illustrates the four hoppers from which the jackets, lead point fillers, steel cores, and lead heel caps are fed.

The cannelure cannot be knurled on armor-piercing bullets during this operation, which is the method of producing the cannelure on ball and tracer bullets, because the pressure that would be imposed on the tungsten steel core of armor-piercing bullets in the crimping operation might cause the jacket to split. The cannelure is, therefore, turned on armor-piercing bullets by employing machines of the design shown in Fig. 33, which are built by the Black Rock Mfg. Co., Bridgeport, Conn. With the assembled cartridge held in a collet chuck, a form

*Fig. 28. Between the Drawing Operations, the Jackets are Washed and Water-polished in Tumbling Barrels*

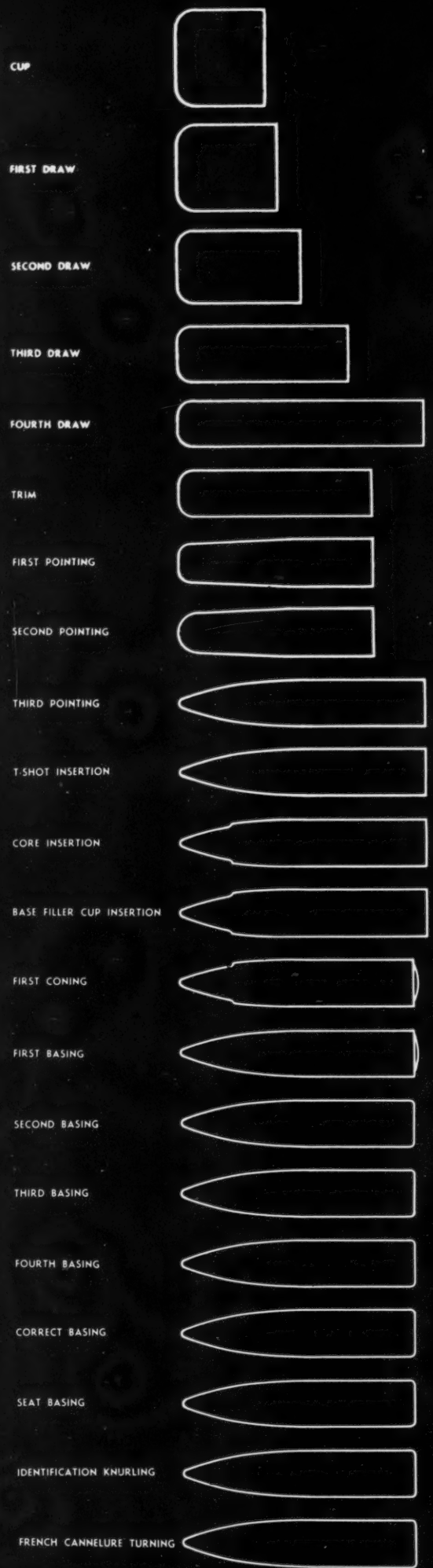



*Fig. 29. Diagrammatic Illustrations Indicating the Successive Steps in Producing Bullet Jackets*

cutter on a cross-slide at the front of the machine feeds toward the center and cuts the cannelure accurately to the required dimensions. After the cartridges have been assembled and the cannelure has been turned, they are tumbled in Maizo to impart a high finish.

### *Primer Manufacture and Insertion into Cartridges*

Primer manufacture is carried on in a department that is entirely separate from the cartridge case and bullet production areas, and in which special safety precautions are observed, as necessitated by the fact that an explosive is being handled which will detonate under the impulse of flames, friction, shocks, blows, or static electricity. Everyone entering this department is compelled to grip the handle of a door and thereby dissipate any static electricity that is in his body. No one is permitted to take matches into the department.

Primer cups must be made from a material that will withstand a gas pressure of 50,000 pounds per square inch when a cartridge is fired, without the bottom of the primer cup bursting or blowing out of the cartridge case. The bottom metal must be flexible enough to receive a sizable dent from the impact of the firing pin, and yet not so flexible that rough handling will cause distortion. It must be tough enough to withstand puncture by a sharp firing pin, and yet soft enough to be cold-worked. The alloy generally used is a brass containing 70 per cent copper and 30 per cent zinc.

The metal thickness of the primer cups is also of utmost importance, a tolerance of only 0.0005 inch, plus or minus, being allowed on the specified thickness of 0.027 inch. The blanking and cupping operation must form the primer cup to an outside diameter between 0.2100 and 0.2105 inch. Careful attention must be paid to the straightness of the cup walls. Owing to the diminutive size of the piece, the cup cannot be trimmed or cut off, and yet the cup length must be between 0.121 and 0.126 inch. Washing and drying by tumbling follow cupping.

The anvil, or other metallic part of the primer, also requires careful manufacture, as the sensitivity of firing depends greatly upon the angu-

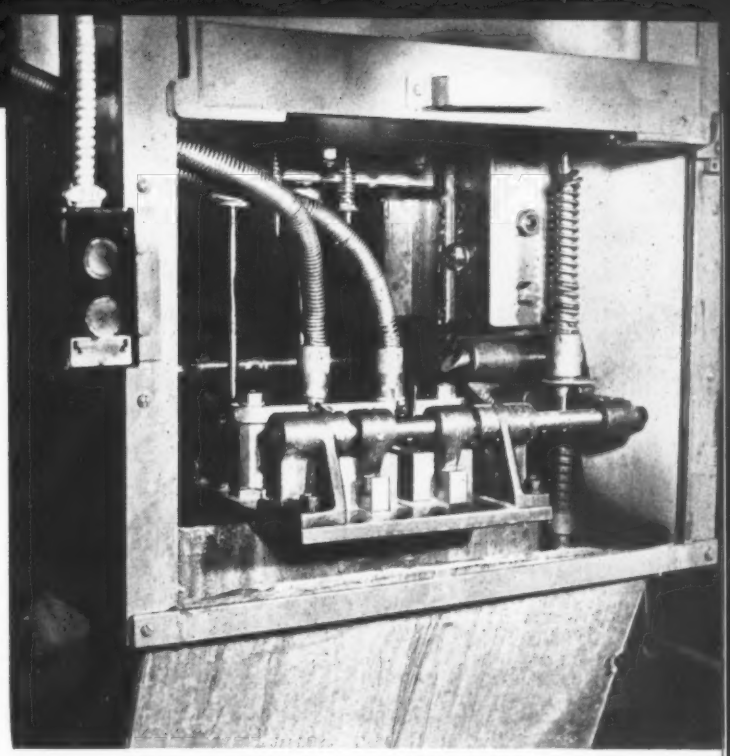


*Fig. 30. The Second, Third, and Fourth Draws are Performed on Bullet Jackets in Straight-sided Presses*

larity of the anvil point. The anvils are produced in a blanking and forming press operation. They are also washed and tumbled.

The primers are charged with an explosive that comes to the charging machine in the form of a dough resembling granulated mud. This mixture is rolled and worked into a series of holes in a steel plate, precaution being taken to insure that all holes are completely filled. Then another steel plate loaded with primer cups is placed over the explosive-loaded plate, after which a third matching plate provided with pins is employed to push the mixture pellets into the cups.

The charging plate is then inserted into a foiling press, the plate being so positioned that each row of cups registers under dies that are equivalent in number to the holes in each row. Shellacked foiling paper is then fed over these dies and, as the plate is indexed progressively, punches come down through the paper and into the dies and insert small disks of paper into the primer cups to hold the powder charges in place. The anvils are inserted while the primer composition is still wet, but they are only partially seated at this time, the seating being completed when the primer assembly is pushed into the pocket of a cartridge case.

Before the primers can be assembled in the cartridge cases, they must be so arranged that they will feed in an inverted position from hoppers to the feeding mechanisms of the assembly presses. The primers reach the assembly department loaded in small cylindrical pasteboard cartons. The operator of a primer inverting machine places a carton of primers in a small brass scoop and pours them into two rotating hoppers, such as seen in Fig. 34. A large dial that revolves in a horizontal plane feeds the inverted primers to a small tray, ready for the assembling machine. Each inverting machine is installed in a booth, so as to safeguard surrounding workers in case of an accident. Each time the contents of one carton have been inverted on the tray the carrier dial is thoroughly cleaned with alcohol to prevent the primer mixture from accruing.

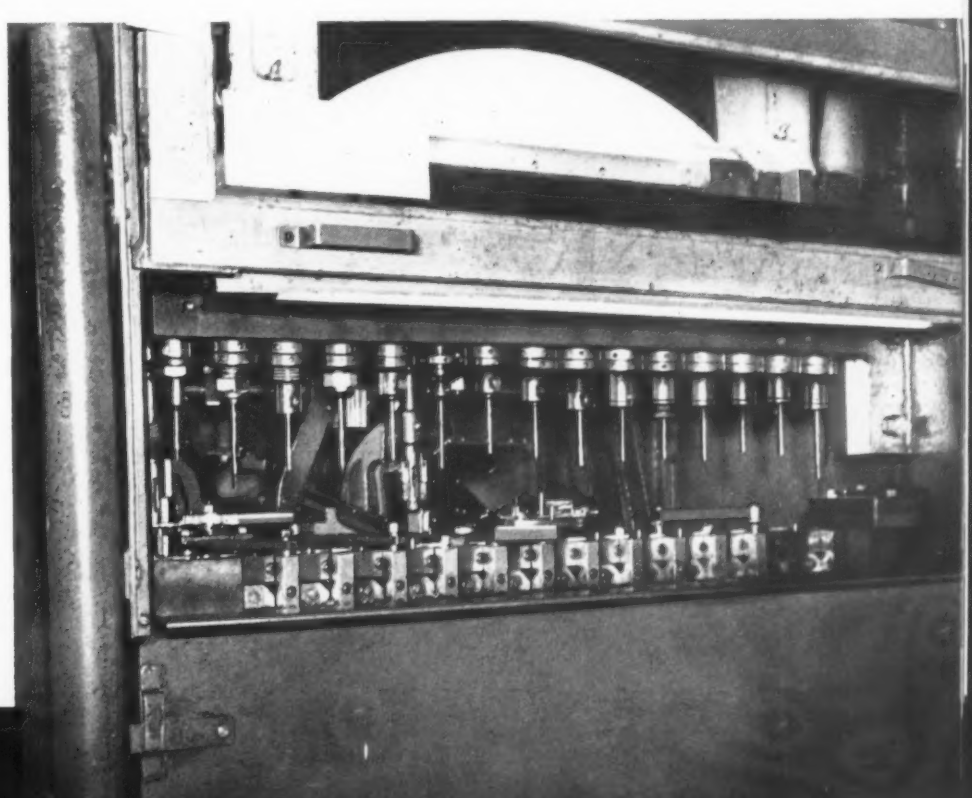


*Fig. 31. In Assembling Armor-piercing Bullets, Machines are Employed that have Fifteen Stations for Performing the Various Steps of the Operation*

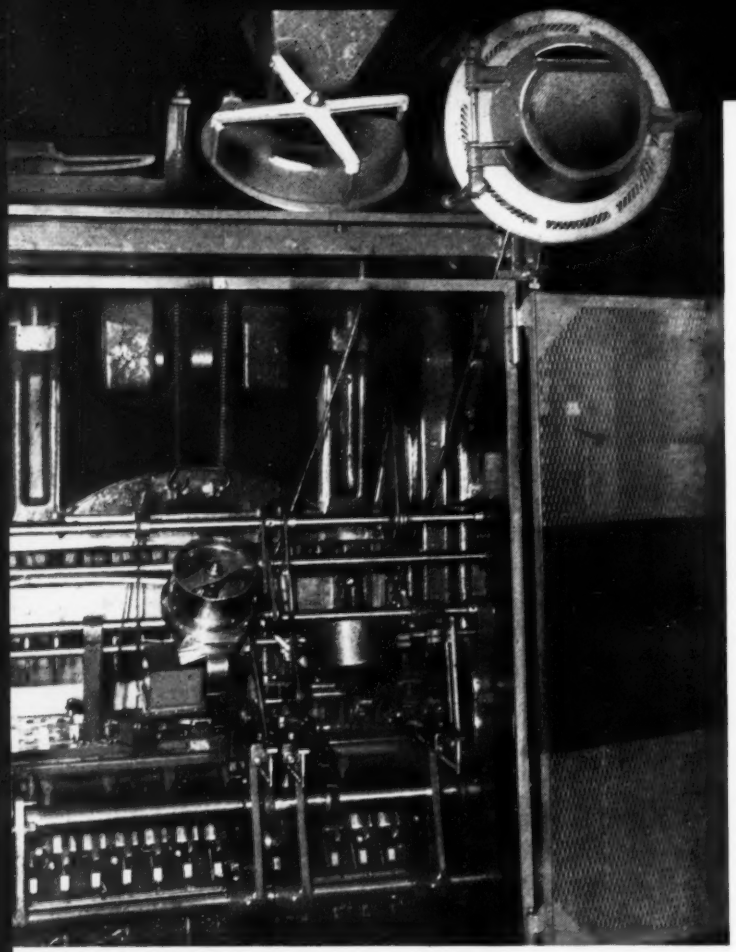


*Fig. 32. Rear View of a Bullet Assembling Machine Showing Four Hoppers Used for Feeding Component Parts to Stations of Machine*

The primers are inserted in the cartridge cases by Henry & Wright machines of the construction illustrated in Fig. 35, which are fed with cartridge cases from "rat-hole" hoppers. The cases are delivered mouth downward into a horizontal straight-line track. A transfer bar advances the cases, one at a time, to a series of stations. In the first station, an arm descends to make sure that a cartridge case is in place. If there is no case, the machine will be automatically shut off and the operator must load a case manually into this station before the machine can again be started. Were it possible for the machine to operate without a cartridge case in any one station, a primer fed into the transfer track might be exploded.

In the second station of the machine, a conical-shaped burring tool descends and opens the top of the primer pocket in the base end of the cartridge case. In the third station, the cartridge case arrives above a hollow piercing stem and beneath a flash-hole piercing punch. This punch produces a clean hole in the center of the cartridge case bridge or web without forming chips or burrs that might cause hang-fire or misfire when a gun is discharged.

The fourth station of the machine is used as a detector for cartridge cases not having a flash-hole. Should such a case reach this position, the machine would again be automatically stopped, and it would be necessary for the operator to replace the defective case with one having a flash-hole before the machine could be started again. The next station serves also to detect cartridge cases without flash-holes, the detector device being similar to the one in the preceding station, but more sensitive.

The primers are inserted in the base of the cartridge cases in the sixth station. They are fed from a hopper in which they have been carefully placed, and which is provided with a slanting bottom that enables the primers to slide slowly to an endless steel belt. One at a time, the primers are gripped by flipper fingers which travel in an arc between a feed-finger and the primer pocket of a cartridge case. It is essential that this mechanism be accurately timed or else primers will be detonated instead of assembled.

In the next working station of the machine, the primer is firmly seated and the metal of the cartridge case is compressed around the primer, so as to avoid a loose primer that might cause hang-fire or flare-back when a gun is fired. The cartridge cases then pass a counting device and, finally, a mechanism that applies a shellac waterproof solution around the primer. Another sealing device applies an asphalt varnish solution in the mouth of the cartridge cases. The primed cases move out of the machine on a track from which they are taken to be inspected.

In this checking, inspectors view the outside of the primer and the inside of the cartridge case under ideal lighting conditions, in order to observe defects and insure the rejection of imperfect cases. By looking into the open end of the cartridge cases, the inspectors can readily determine whether the flash-hole has been pierced with a clean cut and whether the primer components are in their properly related positions. The waterproofing is also carefully observed.

### *Loading the Bullets and Powder into the Cartridge Cases*

Two different methods are used for loading the bullets and powder into the cartridge cases. In the plate loading method, agitators, or shaker machines, such as shown in Fig. 36, are used for arranging the bullets and cartridge cases ready to be assembled into complete cartridges. In

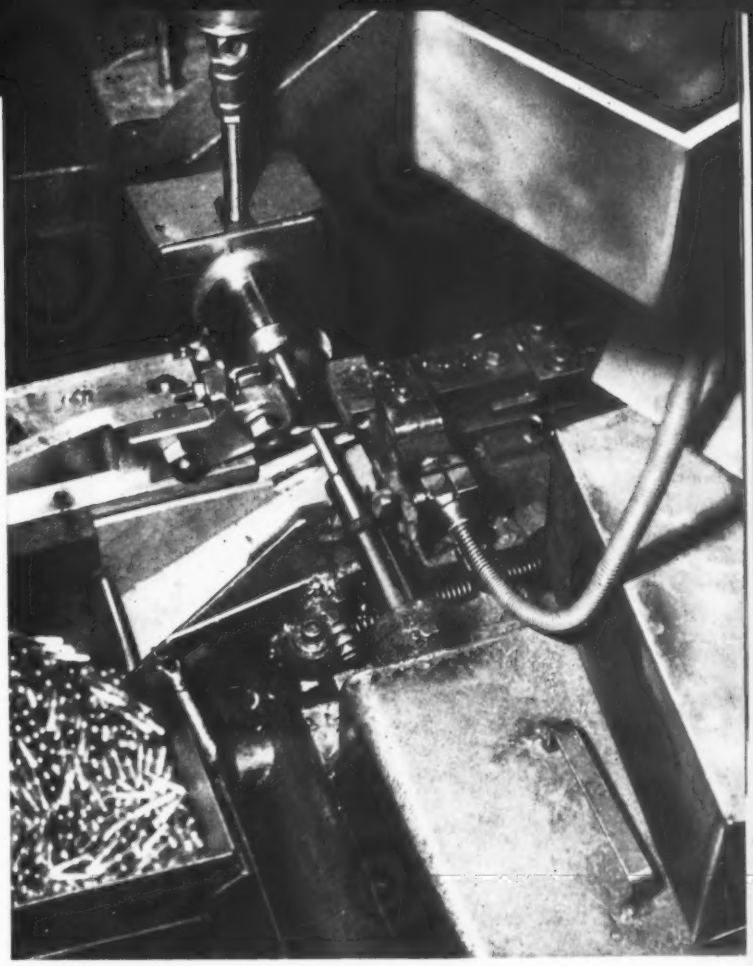


*Fig. 33. The Cannelure is Turned on Jackets for Armor-piercing Bullets in a Lathe Type of Machine by Employing a Form Cutter*

these machines, the cases and bullets are loaded into separate matched plates, which are each provided with 247 holes to receive these components. The plates are placed in the machine, after being covered with either bullets or cases, and are shaken until the components fall into the holes in the plates. The plates are then removed and the components transferred to a loading plate.

Next the case-loaded plate is put in a charging machine and inserted beneath a series of four plates having the same number of holes as the loaded plates. The two upper plates are adjustable to permit a variation in the powder charge. The next plate is movable, so that its holes can be placed out of registration with respect to the upper plates. The bottom plate is fixed, with its holes registering with the two top plates. The movable plate is used to shut off the holes in the measuring plates when they are to be charged.

Charging is accomplished by feeding a hopper back and forth through the manual operation of a crank. When the proper amount of powder has been fed into these holes, the movable plate is brought into registration with the holes in the measuring plate, thus allowing the powder charge to drop through the bottom plate and into the cartridge cases.

After the cases have been loaded in this manner, the transfer block is taken to a powder gage, which consists of a perforated plate having 247 floating brass stems. When these stems are lowered into the cases, the head ends will stand above the top of the gaging plate if the powder charge is too high, and will be below the surface of the plate if the charge is too low.

The bullets are next inserted in the cartridge cases by placing an intermediate plate over the cartridge case plate. Then the bullet loaded plate is placed on the intermediate plate with a sliding plate between. When the sliding plate is withdrawn, the bullets fall onto the top of the cases in the intermediate plate. The plate assembly is then indexed through a seating press that is provided with a row of punches for forcing the bullets into the cases. The intermediate and bullet plates are then removed, and the shell plate indexed through a crimping press for closing in the end of each case around the bullet, so as to hold it in position.

This operation is performed in a vertical crank press equipped with 247 small collets which compress the metal at the mouth of the cartridge cases into the cannelure of the bullet jackets to hold the bullets firmly in place. The location and depth of the crimping affect the bullet pull and, proportionately, the bullet velocity. The crimping and seating machines are also installed in fireproof booths, and cannot be operated unless the safety glass windows, which are raised for loading and unloading the transfer cases, have been lowered into the operating position.

The alternate process of loading the bullets and powder into cartridge cases is called "straight-line loading." Fig. 37 shows the type of machine used for this process. The cases are fed from a hopper to a dial under a powder-filled hopper. At the first station, a metered charge of powder is admitted to the cartridge case, which is then moved to the next station, where a bullet, which has been fed from another hopper, is inserted. The bullets and cases are then carried to another station, where the bullets are forced into the case. At the next station, a crimping tool comes down and closes the mouth of the cartridge in around the mouth of the bullet. The finished cartridge is then turned over, dipped into the identifying lacquer, and fed into a drying dial, from which it is later ejected from the machine.

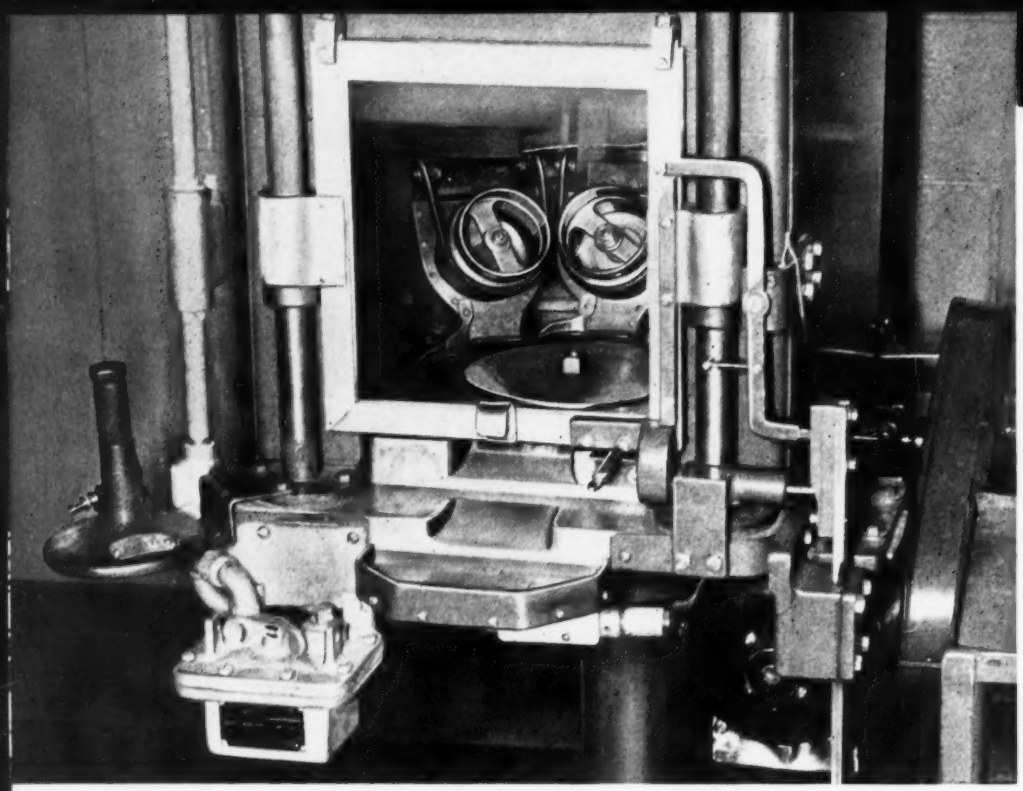


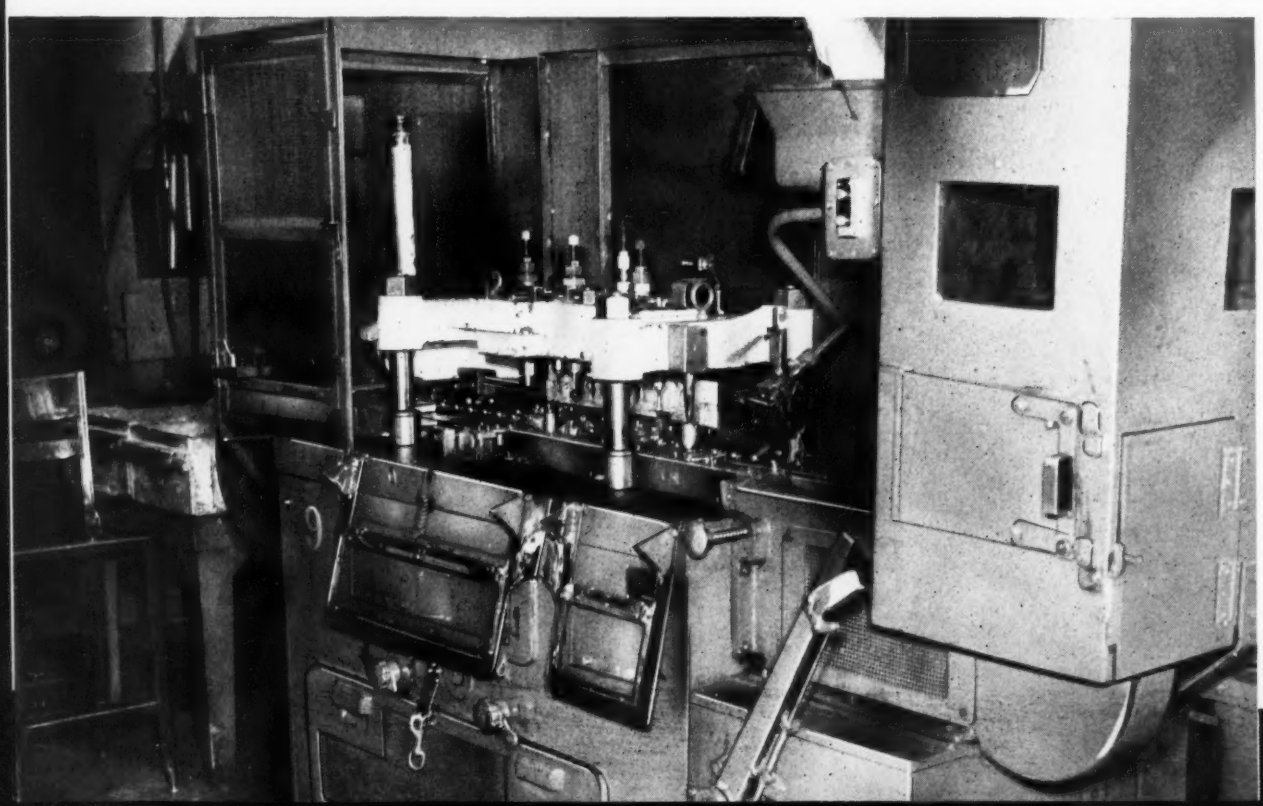
*Fig. 34. Machine Used for Loading Primers in an Inverted Position into Trays Ready for Assembly into the Cartridge Cases*

### *Final Inspection of Assembled Cartridges*

Final inspection of the cartridges is performed by machines that not only check dimensions and weight, but also reject bullets that fail to meet specifications. A general view of one of these machines is seen in Fig. 38. A girl operator loads the cartridges into the hopper of this machine, and they are automatically transferred to an indexing wheel that revolves in a vertical plane. The cartridges are inserted horizontally into bushings in this wheel for a portion of their length. In the event that a cartridge is deformed or is too large to be pushed fully into a bushing, the machine will stop automatically.

Each cartridge is discharged from the indexing wheel to a reciprocating transfer bar, which extends the length of the machine and carries the cartridges to six inspection stations, where they are checked for various lengths and diameters. The transfer bar rises at the end of each cycle, moves to the left, is lowered on the cartridges to

*Fig. 35. The Primers are Inserted in Cartridge Cases in Machines of the Type Here Shown, which are Provided with a Transfer Bar for Carrying the Cases to Successive Stations of the Machine*



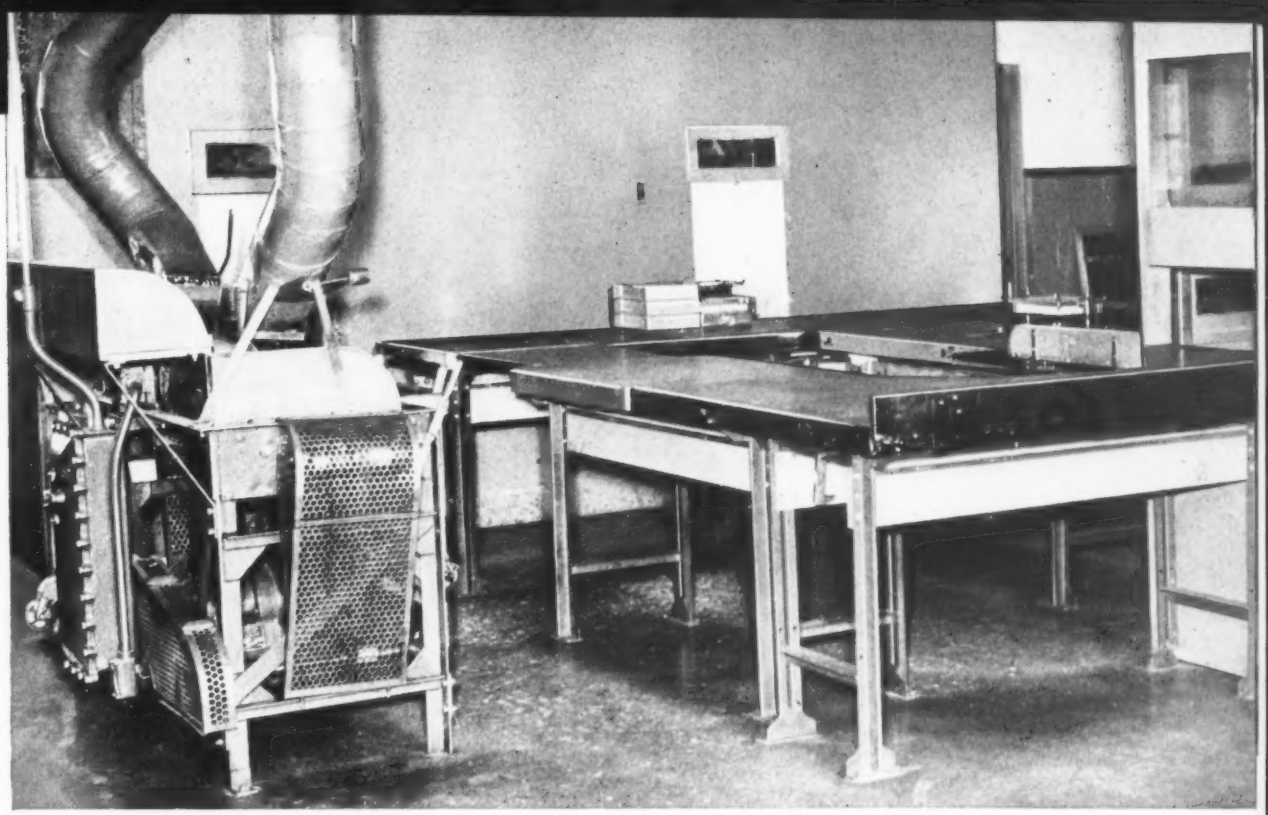


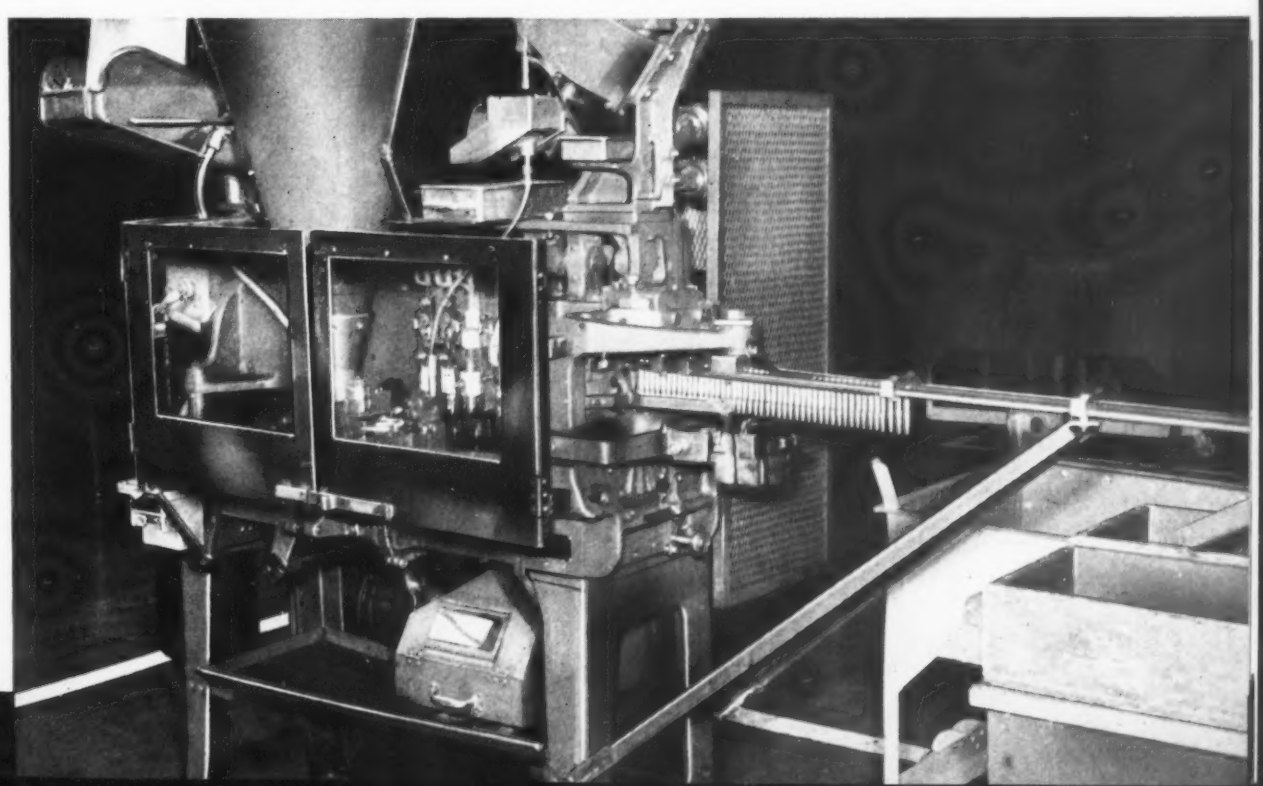
***Fig. 36. Agitator, or Shaker Machine, Used for Arranging Bullets and Cartridge Cases for Assembly into Complete Cartridges***

be transferred, and returns to the right to complete another cycle.

As each cartridge starts on its journey to the several inspection stations, a ball is moved directly in line with the cartridge by a conveyor screw at the front of the machine, as seen in Fig. 39. At each inspection station, a rocker arm comes in contact with the cartridge, and if the dimension being checked is within the desired limits, the opposite end of the rocker arm can enter a hole in the center of a head on a plunger at the front of the machine, and no movement is imparted to the plunger.

However, if a cartridge does not pass inspection at any station, the corresponding rocker arm will be tilted sufficiently to prevent its front end from entering the hole in the plunger head, with the result that the plunger will be pushed toward

***Fig. 37. Type of Equipment Employed in the Straight-line Loading Method of Assembling Bullets and Cartridge Cases***



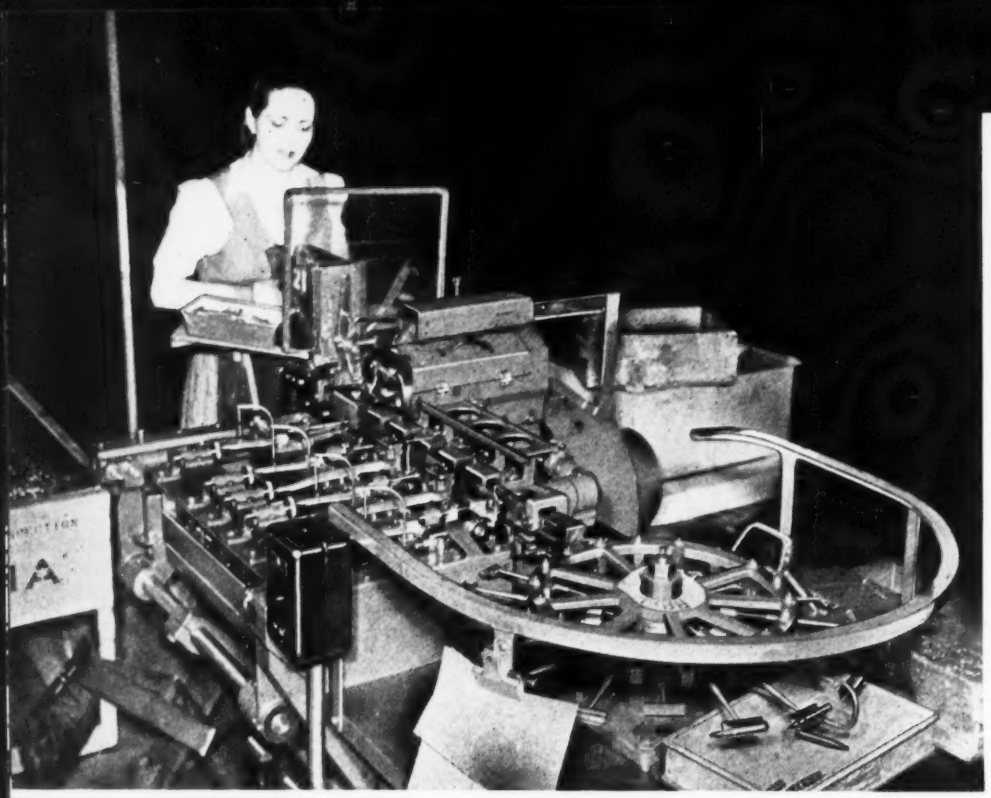


*Fig. 38. Machine that Automatically Checks Assembled Cartridges for a Number of Dimensions and for Weight, and Rejects Those Cartridges that are Defective in Any Respect*

the front of the machine. This action will cause a corresponding finger to kick the ball that is directly in line with the defective cartridge from the front to the rear side of the conveyor screw. The ball will then pass under a cam, which will cause a latch to be opened beneath the work transfer bar, thus permitting the defective cartridge to fall into a container. As there are separate containers for each of the inspection stations, the operator of the machine can readily determine the reasons the various cartridges have been rejected by the machine.

When a cartridge that passes all of these inspections reaches the right-hand end of the transfer bar, it falls on one of the hinged arms of the large revolving wheel seen in Fig. 40. Cartridges with a light powder charge will not depress the outer ends of the arms sufficiently to enable the cartridges to pass the stationary arm seen at the left. The result is that such cartridges will be knocked off the arms and will drop into a rejection box at the side of the machine. Cartridges that meet the weight requirement pass on to the station seen in the foreground and are pushed from the arms by a bracket to a chute that leads to a batch box.

All the cartridges that pass these inspections are turned over to inspectors of the Army Ordnance Department for complete rechecking. Should any one cartridge in a batch of thousands be rejected, the whole batch is returned to the manufacturing department for re-inspection.

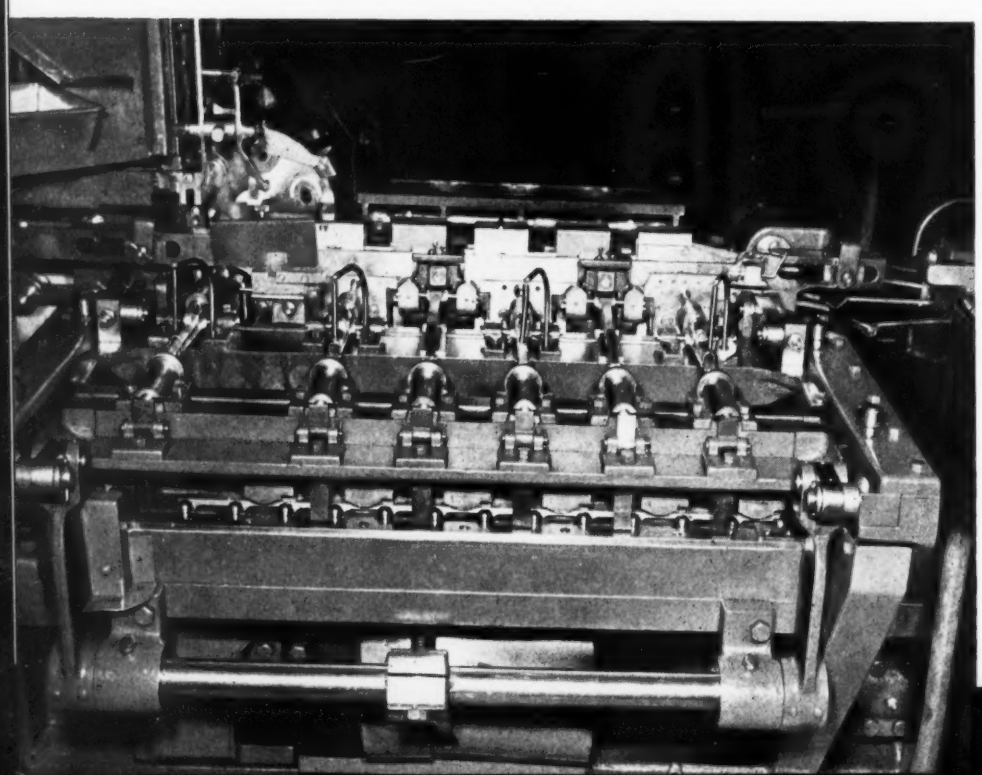


*Fig. 39. Close-up View of One of the Inspection Machines, Showing the Mechanisms Employed in the Several Stations to Reject Every Cartridge that is Defective so far as Dimensional Accuracy is Concerned*

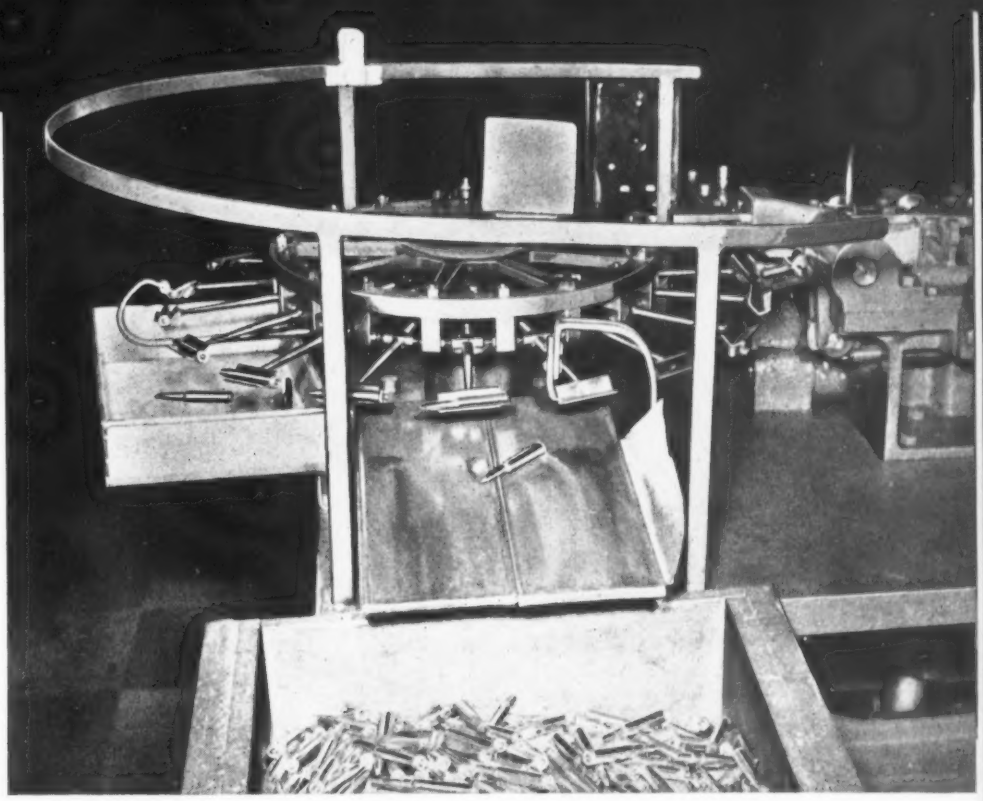


*Fig. 40. The Rotating Wheel at One End of an Inspection Machine that Checks Cartridges for Weight and Rejects Any that have Insufficient Powder and are, therefore, Too Light*

Cartridges are fired in large quantities in a ballistics department by both company and Army inspectors to insure proper performance on the battlefield.

All cartridges accepted by the Army Ordnance Department go to a shipping department equipped with packing and boxing machines and gravity and overhead conveyors that carry the boxes to the railway shipping platforms. The pasteboard containers and the wooden boxes are manufactured at the plant, and printed with suitable identification markings.

# Women in War Production

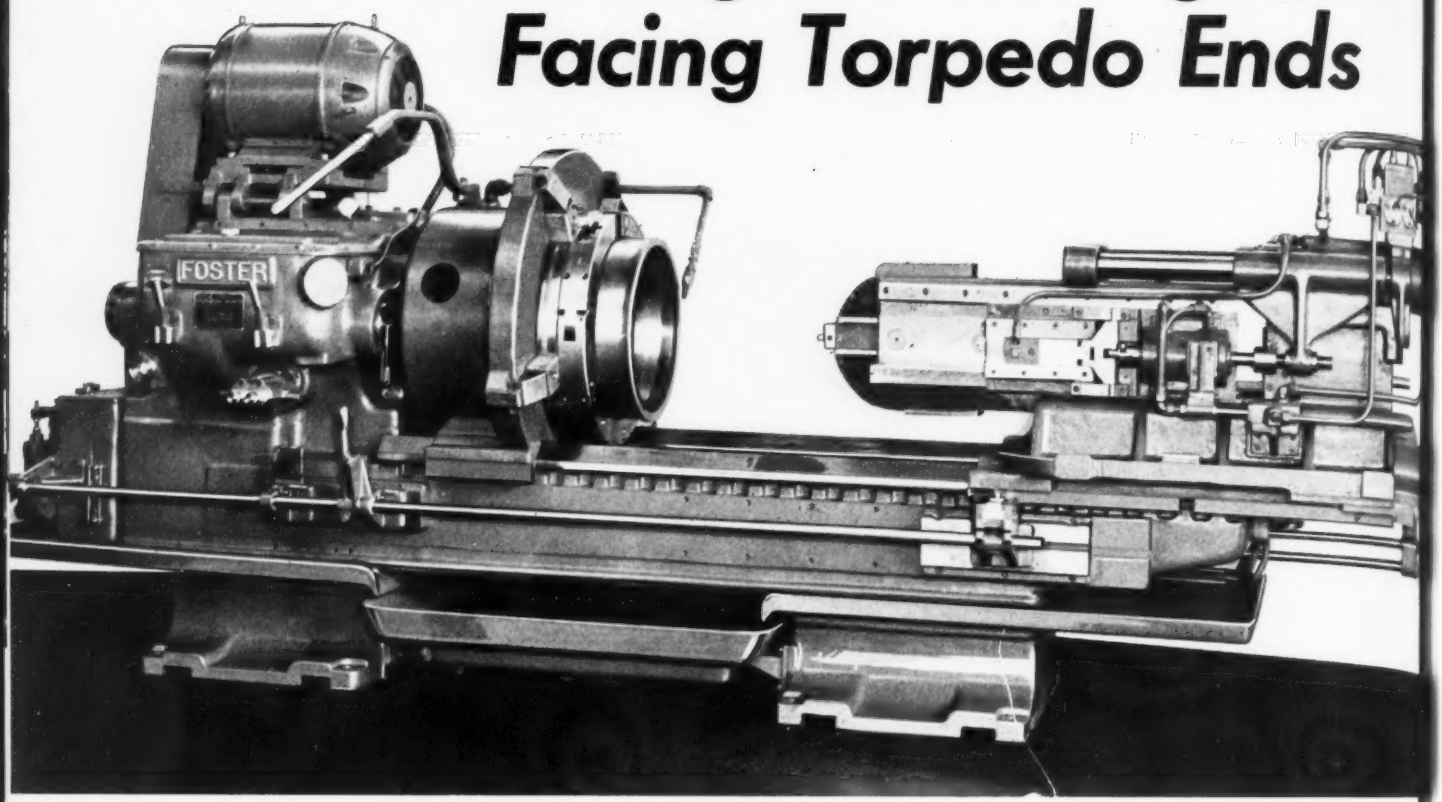
IN an address given before the recent meeting of the American Society of Tool Engineers in Milwaukee, W. A. Simonds of the Willow Run bomber plant, emphasized that the most important thing in the employment of women was to "start" them right. It has been found that for repetition production jobs, women require from about a week to ten days' longer training than men. It has also been found that women will show much more interest in their work and do better work if they know how their individual job fits into the entire production picture. "When they don't," he said, "we have found that they frequently quit." He also mentioned that women operators on overhead cranes in the Willow Run plant have reduced maintenance by some 50 per cent, because they are inherently more careful.

On the other hand, the problem of absenteeism becomes more acute as the employment of women increases, because women stay away from work to a greater extent than men, due to the fact that they consider their own personal problems more important than their jobs; this is doubtless because half of the women employed look upon their jobs as temporary.

At the same meeting, Dr. B. I. Beverly, director of health and personnel of the Republic Drill & Tool Co., Chicago, Ill., mentioned that of the 2000 employes of his company, 85 per cent are women. In equipping the plant, he said it had been found desirable to redesign many machines for operation by women, adding, however, that many of the redesigned features will be just as useful when the machines are operated by men—thus representing long-range benefits to all industrial workers. Among the practices of his company are the provision for ten-minute rest periods every two hours, and the playing of recorded music for twenty minutes during every hour.

For inspection work, especially on small, delicate parts, women have been found to be conscientious and accurate—often excelling men.

# Tooling for Boring and Facing Torpedo Ends




By I. F. YEOMAN
Foster Division
International Machine Tool Corporation

ONE of the recent developments in machine tool equipment designed specifically for war production is a special tooling unit which has been applied to the 4-F platen type Foster Fastermatic for boring and facing torpedo ends. The equipment, shown in the heading illustration, was engineered and built by the Foster Division of the International Machine Tool Corporation, at Elkhart, Ind.

The work-piece is a steel forging, which is bored and faced to dimensions specified by the U. S. Navy Department. The boring and facing

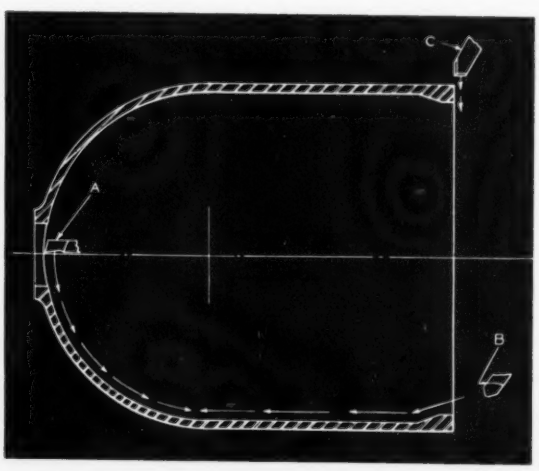



*Fig. 1. Steel Casting Forming Torpedo End is Spherically Bored, Cylindrically Bored, and Faced in Simultaneous Operations. Arrows Show Feeding Directions of Tools A, B, and C*

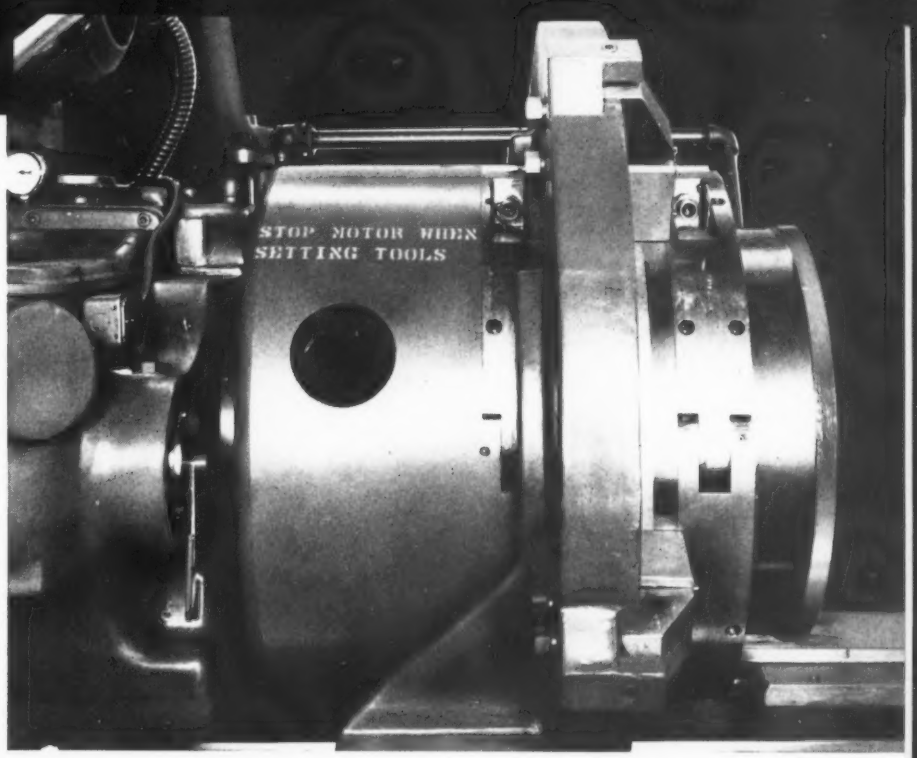



*Fig. 2. Side View of Work-holding Fixture, Showing Two Sets of Cylindrical Jaws and Steadyrest Location*

operations require that directional feeding movements be imparted to the cutting tools, as indicated in Fig. 1 for cutters *A*, *B*, and *C*. These feeding movements are imparted simultaneously to all cutters.

The work-piece is chucked in a fixture that is provided with two sets of jaws. As shown in Fig. 2, the jaws grip the forging around a surface previously rough-turned to a given dimension on another type of machine. The jaws are spaced sufficiently far apart to accurately align the two ends of the forging. The outer end of the fixture is supported in a roller type steadyrest, as shown in Fig. 3.

The tooling unit for the complete boring operation is shown in Fig. 4. This consists of a heavy over-arm, cast integral with a saddle which is gibbed to the regular bed ways of the machine. The end of the over-arm is slotted to receive a head carrying the tool-block and cutter for generating the spherical surface at the inner end of the work-piece. The vertical rotary feeding movement is obtained by means of a pinion meshing with a toothed segment integral with the head, and a rack actuated hydraulically.

The side of the over-arm is also machined to receive a compound cutter-slide for the boring operation. This boring operation is continuous over the entire internal surface, from the outer end of the forging up to the area where the cylindrical surface is blended with the spherical surface. The latter is completed by the time the boring cutter reaches the blending area. A second cutter, not shown in Fig. 4, is set up in the slide for rough-boring the outer end before the taper bore is started.

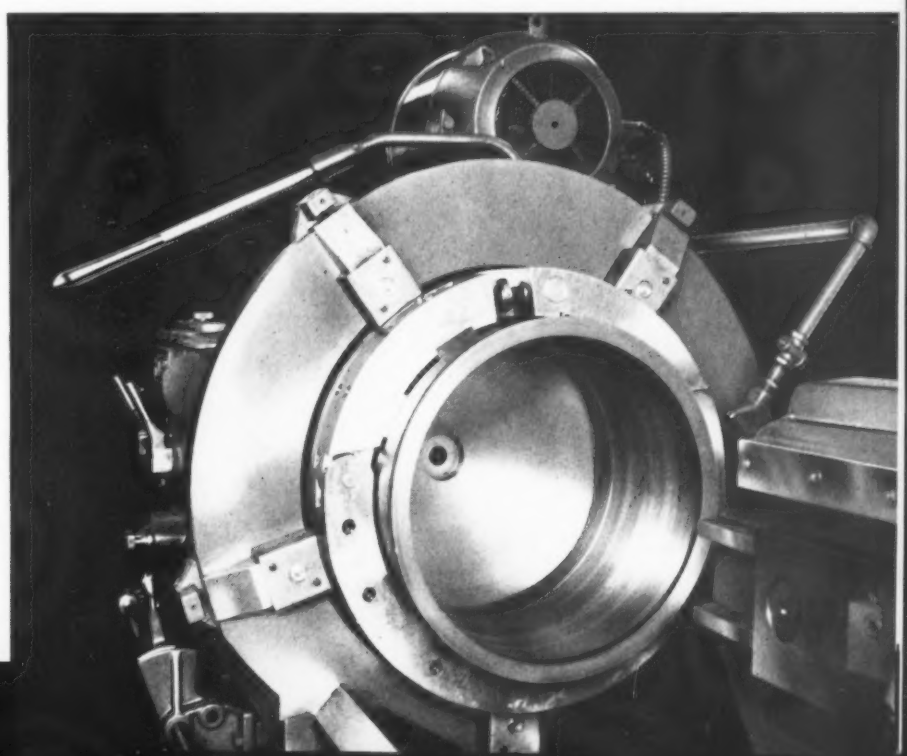


*Fig. 3. End View of Work-holding Fixture, Showing Roller Type Supports Used in Steadyrest and Rough-bored and Faced Surfaces of Torpedo End*

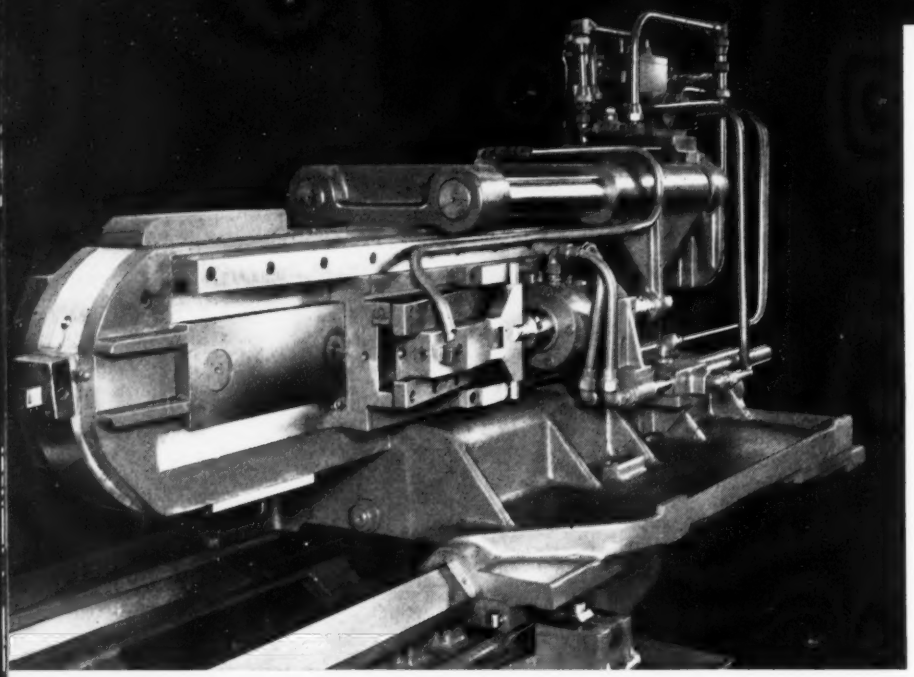


*Fig. 4. Tooling Unit that Performs Entire Boring Operation. Tool at Extreme Left is Rotated Vertically to Generate Spherical Surface. Tool at Center Performs Taper and Cylindrical Boring Operations. Facing is Done by a Gang of Cutters on a Cross-slide that Cannot be Seen in This View*

Pusher-bars for operating the slides and various mechanisms are guided by two overhead pilot bars which give extreme rigidity to the slides when in motion. A cross-slide on the rear of the machine (not shown) carries a gang of cutting tools for facing the end.

The action of the machine is as follows: The saddle carrying the over-arm moves forward rapidly to the point where the cutters are properly located for the start of the feeding movement. It is then stopped, with the cutters in positive position. The cutter mounted on the short auxiliary slide, shown in an angular position, first bores the taper.

At the completion of this operation, the auxiliary slide is retained in its final position, and the slide on which it is mounted feeds forward continuously until the cylindrical cut thus generated blends with the spherical cut produced by the tool in the rotary head at the end of the over-arm. The tooling is then backed clear of the work and the latter is ready for removal. The facing and spherical cuts are completed while the cylindrical boring is in process. All feeding movements are hydraulically actuated; however, a cam is used in conjunction with the hydraulic feed for moving the cross-slide.

To take a second cut for finishing, the work is reloaded into the fixture and the cutting process is repeated. A higher cutting speed may be used for this operation.

The production time for each piece is 1 1/2 hours for the roughing operation and 1 hour for the finishing operation. Under favorable conditions, three machined parts were obtainable per tool grind, using a Stellite No. 98-M-2 tool for the spherical cutting and a Firthite tool for both rough- and finish-boring.

This equipment was designed at the request of a large midwestern concern. The first machine was engineered and under test twelve weeks after the order for the equipment had been received.

# How Machine Tool Rebuilding Aids War Effort

By SAMUEL KOFFSKY, Chief Engineer
Simmons Machine Tool Corporation

*WE cannot wait to re-arm this nation until enough new equipment has been built . . . We must make the best possible utilization of the equipment already installed . . . We must make it work right now . . . instead of sitting on our hands and waiting.* With these words, George T. Trundle, Jr., president of the Trundle Engineering Co., speaking before a combined meeting of the American Society of Mechanical Engineers and the Army Ordnance Association, challenged American industrial ingenuity to make the most of what we have; and the machine tool rebuilder has provided the answer in the adaptation and conversion to war purposes of almost every variety of machine tool, many considered too badly worn or obsolete for further use.

When Germany invaded Poland in 1939, the war effort of Britain and France was materially aided by the use of immediately available used and rebuilt machine tools; and since Pearl Harbor, a great deal of emphasis has been placed in this country on the rebuilding and conversion of machine tools.

Fortunately, during the last fifteen years, machine tool rebuilding has become a generally accepted practice, and unusual rebuilding jobs have been carried out in a short time. Since time is now all-important, many of the war industries requiring additional metal-working machinery have turned to machine tool conversion for the answer to their urgent needs. The field of machine tool rebuilding and conversion covers an extensive range—from converting old countershaft-driven machines to motor drive to applying motor power rapid traverse to boring mill rail-heads and lathe carriages, or rehabilitating discarded machine tools, many with vital parts missing.

An outstanding job of rehabilitation was done some time ago by the Simmons Machine Tool Corporation, Albany, N. Y., in rebuilding two 990,000-pound gun lathes, with 110-inch swing, which had been stored by a large eastern steel company since the end of the first World War. Twenty years of idleness, it was believed, had made them almost worthless; but they were sorely needed to turn some of our largest gun forgings. To build new lathes would require a year or longer. Close examination disclosed that

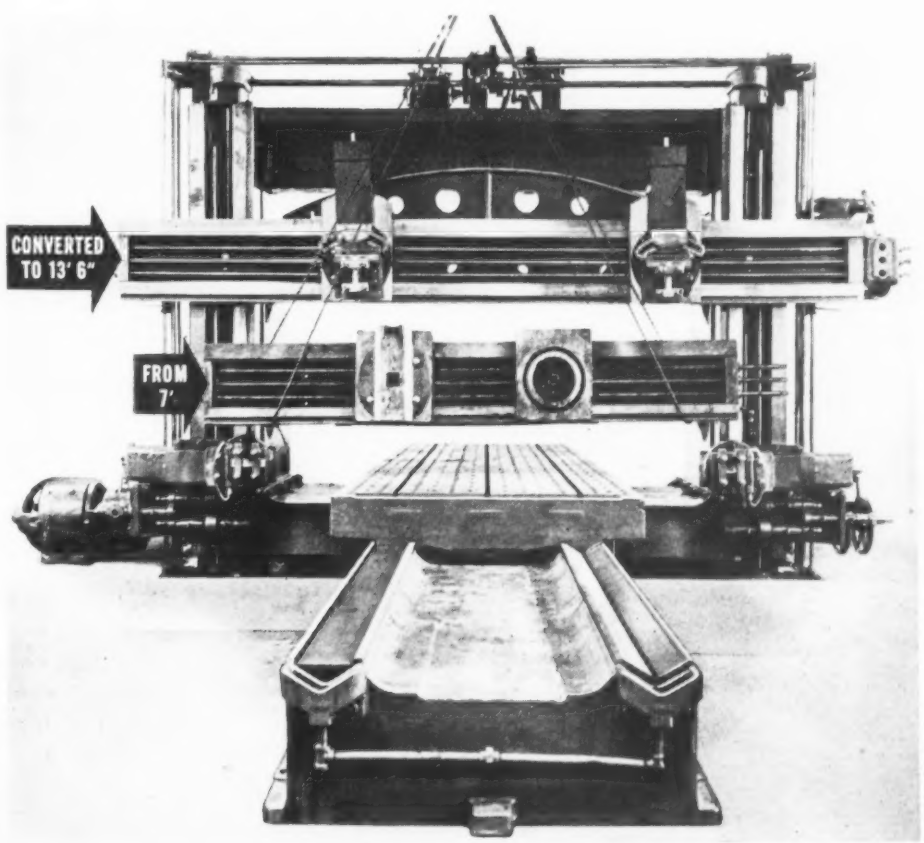



*Fig. 1. A Heavy-duty Planer with Capacity for Work 7 Feet Wide, Rebuilt to Take Work 13 Feet 6 Inches between Housings*

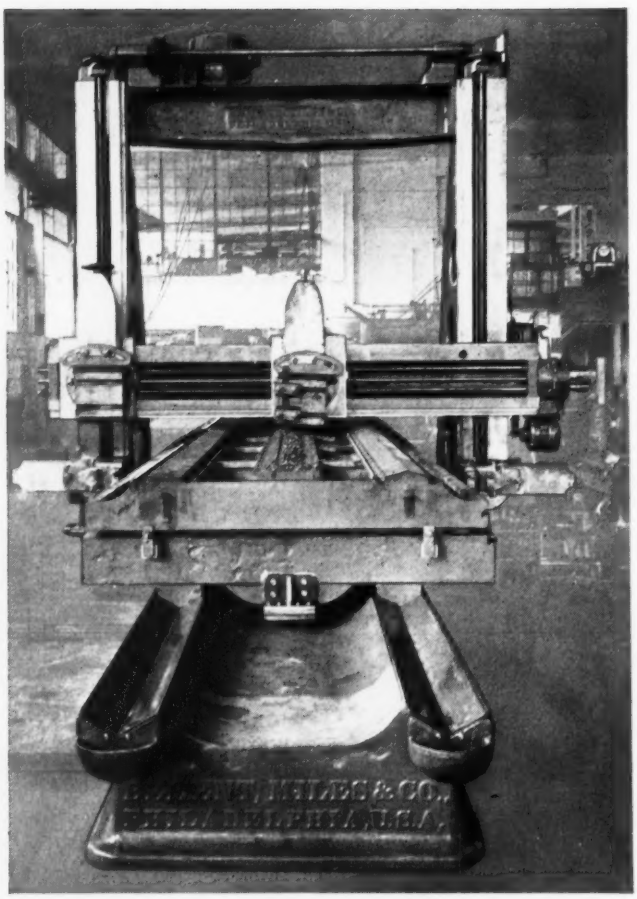


*Fig. 2. A 35-year-old, 10- by 26-foot Bement-Miles Planer, Originally Belt-driven, Rebuilt with Variable-speed, Direct Motor Drive, Box Type Table, and Forced-feed Lubrication*

it was practical to rebuild these lathes, and in less than three months, these veterans of the first World War were back on the job, ready to turn big guns again.

The dimensions of these lathes are unusual. The bed width is 12 feet, made up of two 6-foot wide castings bolted longitudinally. The over-all height from floor to top of headstock is 14 feet 4 inches; the faceplate diameter is 9 feet 2 inches. The headstock motor is 125 H.P., and each of the four carriages has a 15-H.P. motor for power traverse. It required ten freight cars to ship one complete lathe.

Another solution to a vexing problem is shown in the widened planer illustrated in Fig. 1. In this case, the Vulcan Iron Works was confronted with the need for a wide planer to machine marine-engine beds. They had a heavy-duty planer in the shop, 7 feet between housings, but needed 13 feet for the engine beds. The rebuilt planer was 13 feet 6 inches between housings.

The conversion required the manufacture of a completely new cross-rail, including new rail-heads with longer stroke, widening blocks between planer bed and housings, and a new bridge. The illustration shows a comparison between the old rail and the new. An interesting feature of the new cross-rail is the "strong back" or stiffening bridge, which reduces the deflection of the cross-rail over the comparatively long span between the housings. After the machine had been placed in operation, the president of the Vulcan Iron Works, E. Perry Holder, wrote to the Simmons Machine Tool Corporation as follows: "To obtain such a planer new would probably have taken a year. This time was shortened by 75 per cent by means of your rebuilding methods, thus enabling us to speed up our deliveries and help the transportation problem in general." In addition to the marked saving in time, there was a material saving in cost over that of a new planer.

Another good example of modernization and the time it saves is the 10- by 26-foot, thirty-five-year old Bement-Miles planer seen in Fig. 2. This machine belonged to one of the largest

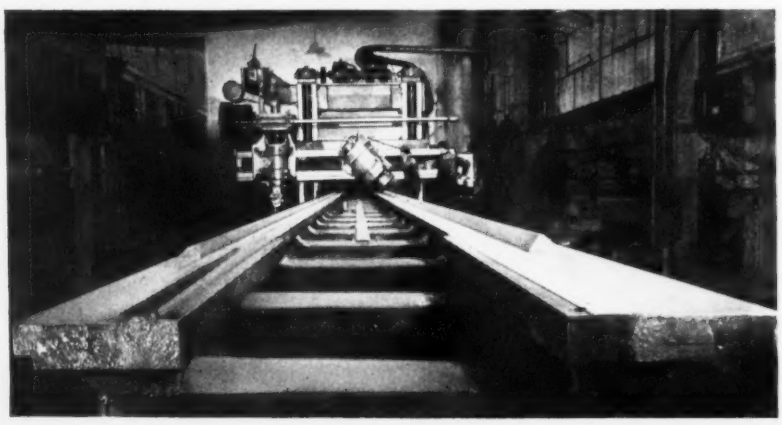
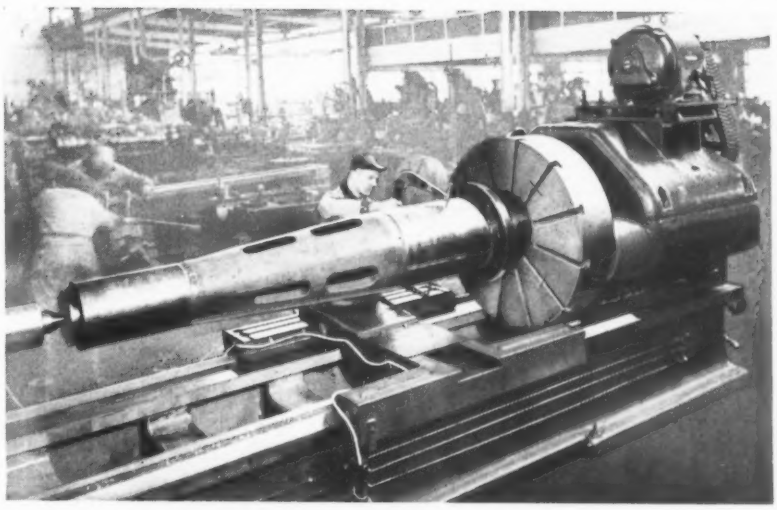


*Fig. 3. A Planer Type Grinder Employed in Rebuilding of Machine Tools, which Can Accommodate Castings 74 Inches Wide, 72 Inches High, and up to 40 Feet in Length*

*Fig. 4. (Right) A Large Rebuilt Lathe, which is Used for Rebuilding Other Machine Tools*

*Fig. 5. (Center) Old Pratt & Whitney Gear-cutting Machine Adapted for Cutting Large Gear*



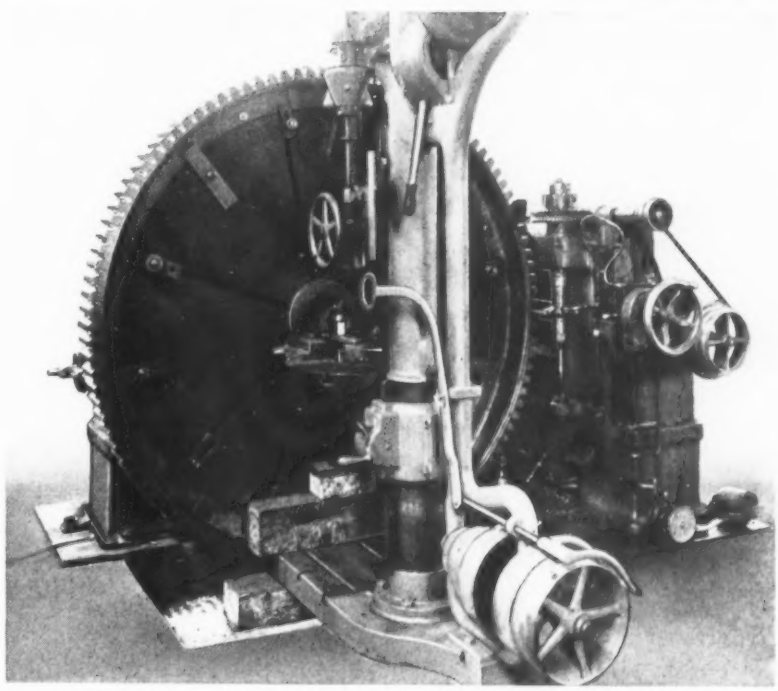
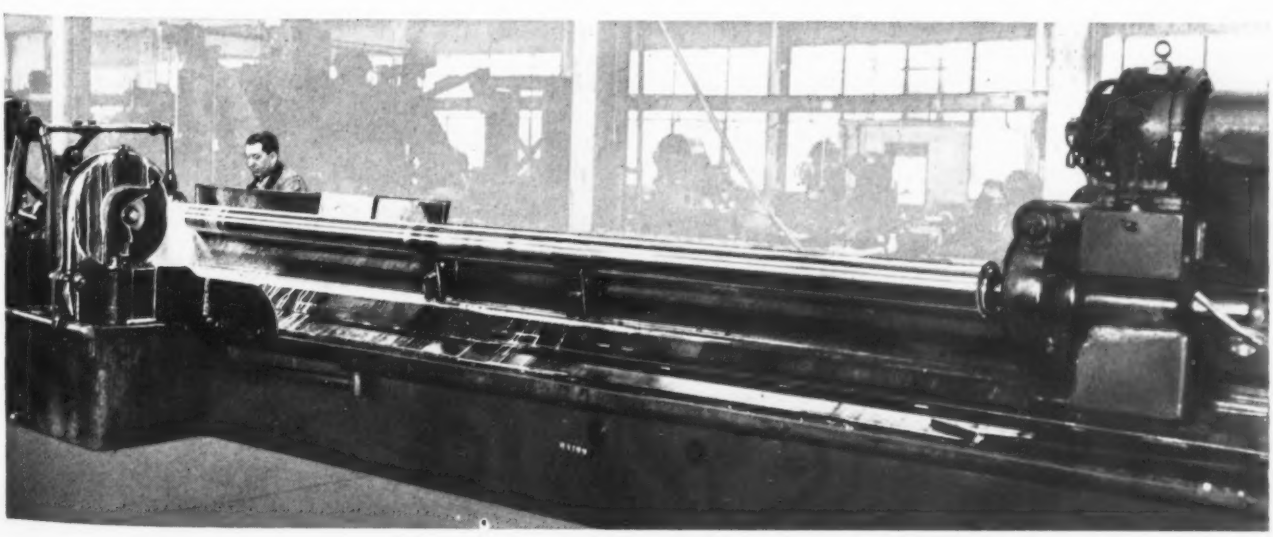


*Fig. 6. (Below) Grinding Machines of Large Size are Employed in Machine Tool Rebuilding*

Diesel engine builders. Originally a belt-driven planer with but one speed for the cutting and return travel of the table, this machine today has many modern features, including variable-speed direct motor drive, all-steel driving gears, forced-feed lubrication of the bed ways, and power rapid traverse to the heads. A new box type table, wider and thicker than the original, is an important feature of this modernized planer.

A gap lathe was provided by rebuilding to enable a marine forge shop to machine large tailshafts. Originally a 60-inch standard lathe, it now has a gap section allowing a swing of 120 inches for a distance of 4 1/2 feet from the faceplate. The rebuilding consisted mainly of cutting the bed casting at the faceplate, spreading it 4 1/2 feet, and bolting it to an auxiliary bed extending sufficiently on either side of the main bed to make the entire lathe virtually a single unit. Clearance of the lead-screw past the gap was obtained by using an outboard shaft



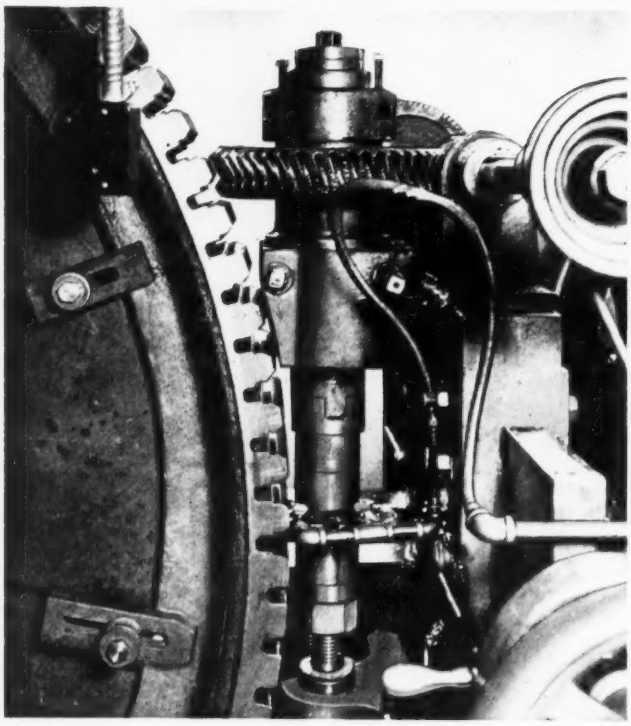


*Fig. 7. The Outside of the Worm-wheel of the Gear-cutting Machine in Fig. 5 was "Profiled" to Provide Clearance for the Large Gear being Cut*

provided with two similar gears at each end.

Existing machine tools provide an excellent source for special-purpose machines. A hydraulic grinder for finishing manganese-steel castings, for example, was built, using a belt-driven metal planer as the nucleus. A new rail and a special grinding head were provided. A 6-inch diameter honed cylinder with a 9-foot stroke gives continuously variable table speeds from 0 to 40 feet per minute, with practically instantaneous reversals. A 2 to 1 differential piston, operating at 300 pounds per square inch pressure, provides a table thrust of 4000 pounds in either direction. Three motors are used—a 15-H.P., 1800-R.P.M. motor for the grinding-wheel head; a 10-H.P., 1200-R.P.M. motor for the hydraulic circuit, providing both the table traverse and wheel feed; and a 3-H.P. geared-head motor to raise and lower the rail.

To rebuild machine tools with the requisite precision and speed calls for varied equipment and skill. Time is a most important factor. All operations must be coordinated to produce precision results with the minimum lost motion. At the Simmons plant, perhaps the greatest time-saver is the specially designed planer type grinder shown in Fig. 3, which can accommodate castings 74 inches wide, 72 inches high, and up to 40 feet in length. Angular as well as flat surfaces can be ground with the grinding head, because of the swivel mounting. Milling and planing can be done by the use of an auxiliary head mounted on the cross-rail. This machine saves a major portion of the hand-scraping time previously required, and can finish a lathe or planer bed in a matter of hours.

A complete manufacturing department must be maintained with facilities to handle from the smallest to the largest parts that might be encountered. Figs. 4 and 6 give an indication of the size of equipment required.

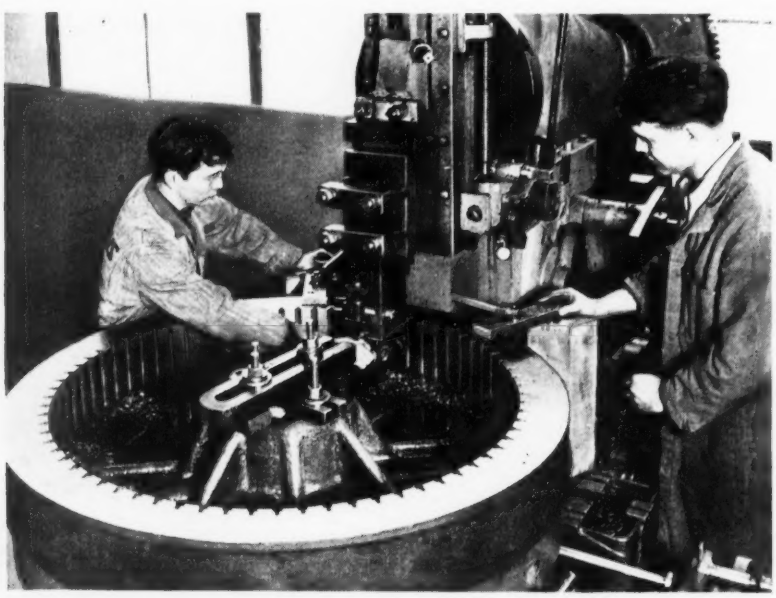


*Fig. 8. An Internal Gear being Cut on a Sliding-head Slotter*

Of particular interest is an automatic welder. This machine, used to build up worn shafts and other cylindrical parts, is one of the first continuous automatic welders ever built. It was designed in 1934 by the combined efforts of the General Electric Co. and the Simmons Machine Tool Corporation. After eight years of hard service, this welder is today doing the same excellent work it did when first put into use.

The experience gained in the rebuilding and conversion of machine tools over a long period of years is reflected in the many unusual expedients that may be seen in the Simmons plant. Practicing what it preaches, the concern has adapted many of its machine tools

to do jobs far beyond the capacities for which they were originally intended.

A few of these unusual tools are illustrated. Fig. 5 shows one of two wheel-lathe gears being cut on an old Pratt & Whitney gear-cutter beyond the capacity of the machine. The maximum allowable diameter was limited by interference with the worm-wheel through which the cutter is driven. The solution is shown in the close-up view in Fig. 7. The outside diameter of the worm-wheel was "profiled" to follow the contour of the teeth in the large gear. Of course, a new worm-wheel had to be made after this job was completed, but the two required gears were completed long before a larger gear-cutter could be located. The wheel lathe, for which a large railroad shop was waiting, went back into service without delay.

Another gear-cutting job is shown in Fig. 8. Here a sliding-head slotter with accurately indexed rotary table is used to cut the teeth in an alloy-steel internal faceplate gear. Three tools are used, a serrated tool for the initial roughing, and two form tools for finishing.

For boring lathe headstocks, a boring machine of venerable vintage is used, as shown in Fig. 10. Accurate results are obtained through the use of suitable fixtures and individual boring-bars for each pair of holes. The boring mill merely provides the rotation and feed movement to the bars. A universal joint eliminates the need for perfect alignment between the machine spindle and the boring-bars.

*Fig. 9. A Simple but Versatile Radial Drill Made from Odd Pieces of Steel, Welded together, to which was Bolted a Bench Type Drill Press*

Drilling operations are speeded up by the radial drill seen in Fig. 9, which was made from odd pieces of steel, welded together, to which was bolted a bench drill with its base inverted.

Machining the ends of large bed castings is usually done on horizontal boring mills, ma-

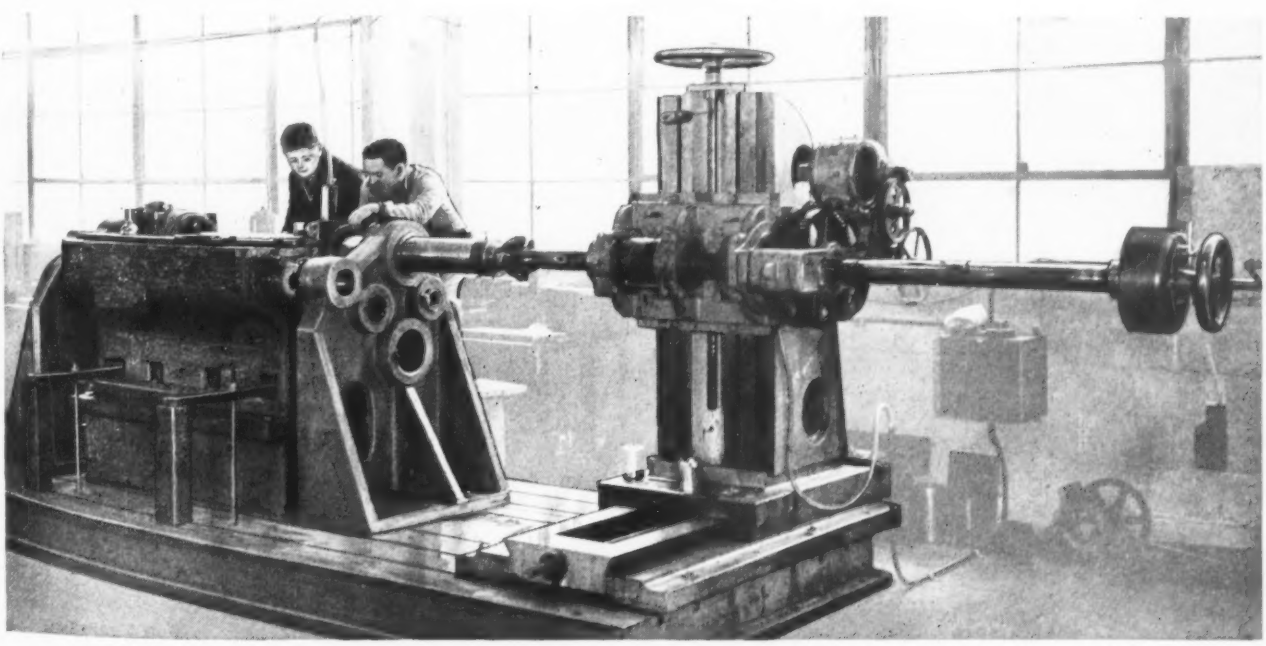
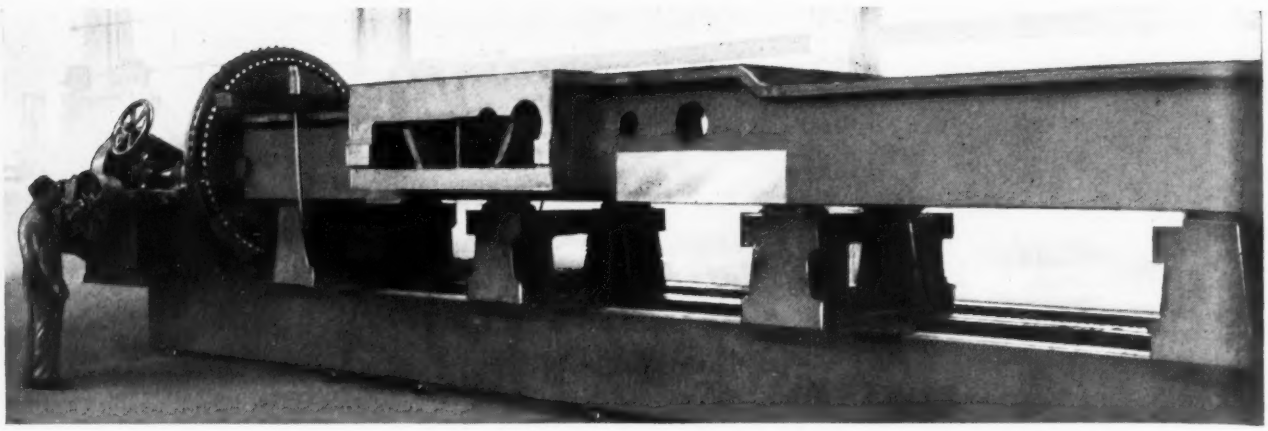


*Fig. 10. An Old Boring Machine Used in Connection with Accurate Jigs for Precision Boring of Lathe Headstocks*



chines that are sorely needed elsewhere for precision boring work. To ease the load on the available floor type horizontal boring mill, end-facing of lathe and planer beds is done on the rotary planer shown in Fig. 11. The 60-inch diameter cutter-head contains seventy-six planing tools, and a single pass of the head finishes castings up to 4 feet in depth and 8 feet in width.

As has already been noted, next to precision, the time-saving element is the most important factor of the rebuilding procedure. In many cases, where a new part or gear is needed, it is made promptly, perhaps at a higher cost, but with no time wasted in waiting for a replacement part to arrive.

Wide experience in the rebuilding field develops an aptitude for coping with so-called "impossible" problems. The Camden Forge Co. required a 36-foot boring mill to machine forged-steel rings that serve as tracks for the gun turrets on battleships. A conventional type of vertical boring-mill would have required many months to complete, besides costing much more than this single job could justify.

To meet the requirements, the special-purpose floor type vertical boring mill shown in Fig. 12 was developed. This giant mill was completed in thirteen weeks, and included a cast-steel gear, 24 feet in diameter, cut in the Simmons shop by an entirely new method of precision indexing. This large gear contains 348 teeth, 1 1/4 diametral pitch, 20-degree involute tooth form, which were cut with a maximum spacing error of 0.003 inch. Completed in 1937, this boring mill has since been operating twenty-four hours daily, turning out turret rings.

In addition to the rebuilding work here referred to, the Simmons Machine Tool Corporation also produces, in its new machine tool division, lathes, planers, cylinder boring machines, turret lathes, and milling machines.

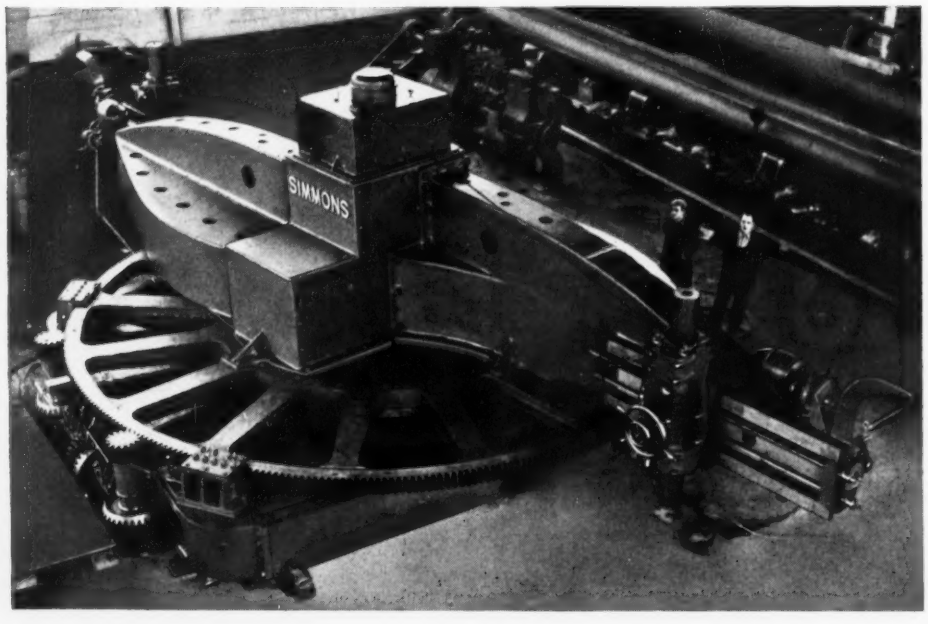



*Fig. 11. (Above) Facing the Ends of Lathe and Planer Beds is Done on a Rotary Planer with a 60-inch Diameter Cutter-head*

VICTORY

*Fig. 12. (Left) Special-purpose, Floor Type, Vertical Boring Mill for Machining Forged Steel Rings of Unusually Large Size*

# Engineering News

## Plastic Molding Material Used for Spray Guns

A manufacturer of spray guns—the Eclipse Air Brush Co.—has turned to plastics as a substitute for aluminum in the manufacture of the handles for its spray guns. The new models, made from Bakelite phenolic molding material, are light in weight and resistant to chemicals and shock. They have now been in use for almost a year, indicating that the material is capable of withstanding the severe usage to which these spray guns are often subjected.

## Reducing Number of Dropped Rivets Solves a Salvage Problem

Salvaging of dropped rivets in airplane manufacture is a costly procedure. It requires sorting for size, cleaning, checking for damage, and in the case of "cold" rivets, rechilling. In trying to provide a means for eliminating this procedure, the Cleveland Pneumatic Tool Co., Cleveland, Ohio, has developed a device known as the "Riv-N-Jector," which not only prevents the dropping of rivets, but relieves the worker from the tedious juggling of a handful of rivets. The device also speeds up the number of rivets driven per minute, and in actual practice, has reduced the waste of rivets by 90 per cent. This device is light, can be easily handled by women operators, and has a magazine holding up to fifty rivets. A special nose jaw holds a single rivet ready at all times to be inserted in the hole of the metal to be riveted.

## A Speed Test Chamber for Grinding Wheels

By equipping tool-cribs with a simply constructed speed test chamber, the General Electric Co., Schenectady, N. Y., has greatly reduced the possibility of accidents from damaged or overspeeded grinding wheels on portable grinders. Workmen are encouraged to bring their grinders to the tool-crib for a test if there is any doubt as to the condition of the grinder or the wheel.

When a worker needs a new wheel for a portable grinder, he takes his grinder to the tool-crib; the attendant mounts the wheel on the spindle of the grinder and puts the grinding wheel end of the spindle into the speed test chamber. Then the test chamber is closed around the spindle and the wheel is started up. In this way, there is no danger to anyone if the wheel should burst while being tested. All new grinding wheels are tested at 50 per cent above normal speed before they are placed in stock.

## Identifying Electrical Wiring for Complicated Control Equipment

The numerous types of electrical instruments and control equipment now being used both in industry and in war equipment require complicated wiring. When wires are marked in a manner for easy identification, the job of making repairs is greatly simplified. This marking, however, presents a number of problems. In the first place, the marking must be impervious to oil and frequently to gasoline. Scotch tape has been used effectively in marking wire terminals, and recently this use of printed Scotch tape has greatly increased. In order to facilitate the printing of such identifications, a so-called Scotch-tape printer has been developed, and is now being built by the York Electric & Machine Co., York, Pa. With one of these small portable printers, an aircraft plant, for example, can provide the necessary symbol markings in a few minutes, compared with the days and weeks required when the printing had to be ordered from an outside source. The printing is done on the under or sticky side of the transparent tape. As a result, the printing ink is not reached by sprays of oil or gasoline, and the printing cannot be erased or destroyed.

## Protecting Conveyor Bearings with Hard Alloys Provides Long Life

Hard-alloy bearings and bearings hard-faced with a similar alloy have outworn ordinary bearings by a service life of over 12 to 1 in a conveyor operated by the Kellogg Co., Battle Creek, Mich. The conditions under which the bearings operate are somewhat difficult, since they are subjected to the constant effect of steam. The alloy bearings have given three and a half years of satisfactory service, and are still showing so little wear that, when removed for inspection recently, they were immediately reinstalled.

# Some Facts on the Coal-Mine Labor Dispute

THE president of the Inland Steel Co., W. Sykes, has addressed a letter to the stockholders of the company in which he presents many not generally known facts pertaining to the coal-mining labor dispute. Since this is a matter of vital interest to all the industries of the country, Mr. Sykes' letter is quoted in the following:

"On Monday, May 3, the United States Government assumed control of the company's large and modern coal mine at Wheelwright, Ky. This was done because there is a labor dispute. But the public has heard only one side of the controversy.

"The president of the United Mine Workers has said that 'the children of the miners are hungry,' and has led the American people to believe that the families of coal miners exist on a sub-standard basis. None of that is true at Wheelwright.

"Take the month of February, for example, which would be typical. There were twenty-four working days in February when work was available for all men who desired to work. Long before the current dispute, the mine was on a six-day basis. We employed on straight day rate in February 783 men in eight classifications. The lowest paid group, consisting of 63 men, were employed at surface labor outside the mine, and a full-time worker received $156 for the month. The lowest paid group who worked inside the mine contained 165 men, and for full time received $175. The highest paid group received $234. The weighted average of all men working day rate and full time was $183.

"We employed 429 coal loaders in February. Their job is to shovel coal into the mine cars. They are on a piece-work basis. Only 69 out of the 429 worked the full twenty-four days. They earned an average of $10.72 per day or $257.28 for the month; 360 of the coal loaders worked less than full time. They averaged only nineteen days per man. But on that basis, they earned an average of $178.98 for the month.

"Another coal occupation in a coal mine is that of 'machine man.' These men operate the machines that cut the coal ahead of loading. We employed 41 such machine operators in February. Only 6 of these men worked the full twenty-four days. They earned an average of $16.90 per day or $405.60 for the month. Individual earnings of such men varied from $323.10 to $505.52 for the month. The other 35 machine operators averaged only fifteen days of work apiece and still earned $236.70 for the month.

"With generous allowance made for sickness and for interruptions due to operating conditions, the rate of absenteeism was nevertheless alarmingly high. If the children of such men are hungry, it is not because their fathers lack an opportunity to make fair earnings, and not because this company's wages are sub-standard.

"No single letter could cover the entire subject of the coal dispute, but we trust that the foregoing facts may clarify the situation."

# Scrap Metal Utilization

IN the production of bus-bars from 1/4-inch flat copper stock, unused ends, often of fair size, are left over as scrap. At the General Electric Co.'s plant in Schenectady, the procedure in the past has been to accumulate all such pieces and transfer them to the Salvage Division for disposition as scrap, this being the regular peacetime procedure.

Recently, however, in order to utilize this metal more efficiently, all pieces having an area of 4 square inches or more are saved. Odd-sized pieces are used in the manufacture of special spacers and similar parts, and more regular-sized pieces are used in the manufacture of larger parts. At the present time, about 90 per cent of the orders for parts less than 8 inches long to be made from 1/4-inch copper are being filled by using this copper. It is estimated that this procedure results in an annual saving of 125,000 pounds of new copper stock.

Somewhat similar methods are employed for the utilization of scrap steel. In the manufacture of switch gear panels, a large tonnage of carbon panel steel scrap is left over from the primary shearing operations. Formerly, this scrap was collected and sold to scrap dealers, although a certain percentage was utilized in making other steel parts.

Now the scrap is accumulated and sorted, and all pieces having an area of 50 square inches or more are saved. They are divided into two assortments—long and short pieces—and are used in the production of a large variety of small parts. During a recent six-week period, 40,000 pounds of such sorted scrap was used for production purposes.

# New Grinding Machine for Carbide Tools

A NEW carbide tool grinding machine that will make unnecessary the employment of skilled labor for this work has been developed through the cooperation of the Carboloy Company, Inc., Detroit, Mich., and the Edison General Electric Appliance Co., Chicago, Ill. While the principles involved have as yet been applied only to single-purpose machines in use at the Edison General Electric plant in Chicago, plans have been made for developing more universal types of machines employing the same ideas.

The need for skilled and specially trained operators for grinding carbide tools is due to the fact that when these tools are ground by conventional methods, sufficient pressure must be applied to the tool on the grinding wheel to provide efficient grinding, but care must be taken not to exert so much pressure that the tip will overheat, resulting in cracking. The tools must be kept moving across the wheel to avoid localized overheating, distribute wear on the wheel, and obtain a good finish. The tools must always be ground toward, rather than away from, the cutting edge to prevent the breaking out of small particles at the edge. The angles to which carbide tools are ground must be held more accurately than in high-speed steel tool practice if the tools are to operate at maximum efficiency and with maximum life between grindings.

It is obvious that a high degree of skill is required when these factors are directly controlled by the operator. The new grinding process referred to removes these factors from the direct control of the operator and incorporates them in the grinding equipment, which automatically provides the required pressure and motions. The grinding wheel, in addition to rotating, also oscillates, while the tool is held stationary at the correct angle. The pressure is applied through air pressure. It is stated that the output per grinding machine is approximately six times that obtained when former methods of tool grinding were used.

A New Carbide Tool Grinding Machine Developed through the Cooperation of the Carboloy Company and the Edison General Electric Appliance Co. The Top Face of Large Carbide Tools is Ground at the Rate of from 80 to 100 an Hour

# Training Young Men for Shop Work

The War Manpower Commission, Apprentice-Training Service, Washington, D. C., has published two booklets of interest to anyone planning to train boys for machine shop work. One booklet, entitled "Apprentice Training for America's Youth," stresses the importance of training boys from sixteen to seventeen years old to carry on the work of those who are old enough for military service. There is urgent need at this time for the services of youths in this age class in war production. Incidentally, such training would also fit them for post-war work.

The other booklet, entitled "The National Apprenticeship Program," reviews apprentice training in the United States, and indicates how the Apprentice-Training Service of the War Manpower Commission, through its 170 field representatives, is in a position to cooperate closely with employers in helping to improve the methods of training workers for jobs requiring all-around skill. The attention now being given to the training of workers is of great value, not only to the war effort, but to the workers themselves.

# Editorial Comment

When the war has been won, credit will go mainly in two directions. First, to our fighting men on land, on sea, and in the air. The gallant courage that they have already displayed warrants assurance of victory, a victory that could never have been won except for the superb qualities of officers and men alike.

Next, credit will go to our industries, the industries that in an incredibly short time converted from the production of peacetime products to the making of implements of war. Several groups deserve a share of this credit. Credit is due to the industrial leaders who conceived of the possibility of performing this feat, and who, in many cases, threw overboard all considerations of what would happen to them and their businesses after the war. Credit is also due the machine tool builders who produced the necessary machines by increasing their output sevenfold as compared with their peace peak production.

*Courage of Fighting Men and Industry's Effort will Win War*

Nor should we overlook the thousands of engineers who so capably designed the means by which the implements of war are efficiently produced, the ships built, and the planes constructed. Theirs was no routine job. They tackled new problems and proved that their experience and ingenuity were equal to the job. They were confronted with applications wholly foreign to them, and yet in a few months, the wheels in these converted plants were turning again, producing cannons and tanks and shells and fuses in place of the thousand-and-one peacetime products that they had previously furnished to a peaceful nation. Many of these engineers have literally worked day and night to complete their task.

And last, but not least, credit must be given to those skilled workers who faithfully performed their allotted tasks with full realization of the serious peril that faced the nation, who worked long hours to provide the fighting forces with the equipment needed, and who refused to listen to that group of self-appointed leaders of labor who urged them to relax their efforts and who fomented strife and strikes at a time when tens of thousands of young men were giving their lives for the nation.

When the war is over, let us not forget to add to the credit that we shall then give to the leaders of our armed forces and to the fighting men the credit that is due our industrial leaders and their supervisory staff, our engineers, and the conscientious workers throughout industry.

The drafting of skilled men from war industry plants for the armed forces continues to present a difficult problem, both to the shop management responsible for production and to the local draft boards. It is obvious that all men with mechanical skill and experience cannot be exempted from military duty. However, there are some men in every war manufacturing plant whose skill and experience it is practically impossible to replace at short notice.

*Draft Boards Need Members who Know Industrial Work*

In order that a draft board may intelligently pass upon questions of this kind, it is necessary that there be at least one man on the board with thorough industrial background and shop experience. In many cases, the draft boards are composed of men who have no understanding of the problems of industry and who think that anyone who works with his two hands can be replaced by anybody else who has two hands to work with.

Since the successful conclusion of the war depends chiefly upon two factors—the armed forces and the industries that produce the equipment for the armed forces—it would seem that draft boards should be composed of men who are able to judge as to the requirements in both these directions. Unfortunately, however, many draft boards are made up of men who have no real understanding of the requirements of either of these two important aspects. Before it is too late, it would be well if steps were taken by the War Production Board to initiate action on the part of the governmental agencies concerned to see that every draft board, especially in industrial communities, has among its members at least a few men who understand manufacturing requirements and the importance of industry in mechanized warfare.

# Gear Manufacturers' Annual Meeting

THE twenty-seventh annual meeting of the American Gear Manufacturers Association, held at the Westchester Country Club, Rye, N. Y., May 17 to 19, was attended by over one hundred and fifty members and guests associated with the gear industry—the largest attendance in the history of the Association. The meeting was opened by the president of the Association, John H. Flagg, president of the Watson-Flagg Machine Co., Inc., Paterson, N. J.

One session was devoted to the subject of "Gears in the National War Effort." The introductory address was made by R. C. Sollenberger, deputy chief of the Material Handling Equipment Branch of the War Production Board. At this session, Major John D. Tebbin of the Army Air Corps and Captain B. P. Ward of the United States Navy also addressed the members.

An important address was made by Frank W. Curtis, chief engineer of the Van Norman Machine Tool Co., Springfield, Mass., who spoke on "Newly Developed Methods for Induction Hardening of Gear Teeth." In his address, Mr. Curtis covered some of the results that are being obtained by high-frequency induction heating for the hardening of gears. John O. Almen, research engineer of the General Motors Corporation, spoke on "Improving the Fatigue Strength of Machine Parts."

Granger Davenport, assistant chief engineer of Gould & Eberhardt, Newark, N. J., outlined a simple and efficient transportation plan for employes, organized for the purpose of saving gasoline and tires during the war. Tell Berna, general manager of the National Machine Tool Builders' Association, gave an address on "The Machine Tool Industry at War," in which he briefly outlined the remarkable achievements of this industry. At the annual dinner, Dr. Ruth Alexander spoke on "The Postwar America that America Does Not Want."

During the meeting, Aubrey A. Ross, recently retired from the General Electric Co. after forty-eight years of service, received the Edward P. Connell Award, made annually by the American Gear Manufacturers Association in recognition of individual contributions to the gear industry, the art of gearing, and the work of the Association. The award was established by the Falk Corporation as a memorial to the late Edward P. Connell, vice-president of the corporation.

The following officers were elected to serve for the coming year: President, Russell C. Ball, president of the Philadelphia Gear Works, Philadelphia, Pa.; vice-president, Louis R. Botsai, manager of the gearing department of the Nuttall Works, Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.; treasurer, Paul W. Christensen, president of the Cincinnati Gear Co., Cincinnati, Ohio; and manager-secretary, Newbold C. Goin, Pittsburgh, Pa.

The following new directors were elected: Russell G. Davis, manager, Industrial Gear Division, Foote Bros. Gear & Machine Corporation, Chicago, Ill.; Harry H. Kerr, president and treasurer, Boston Gear Works, North Quincy, Mass.; William H. Kinkead, Jr., manager, Gearing Division, Link-Belt Co., Philadelphia, Pa.; and Raymond B. Tripp, vice-president, Ohio Forge & Machine Corporation, Cleveland, Ohio.

Russell C. Ball, New President of A.G.M.A.

Louis R. Botsai, Newly Elected Vice-president

Aubrey A. Ross, Recipient of Edward P. Connell Award

# Special Devices Used in Aircraft Building

By H. F. SCHWEDES, Factory Manager
Texas Plant, North American Aviation, Inc.

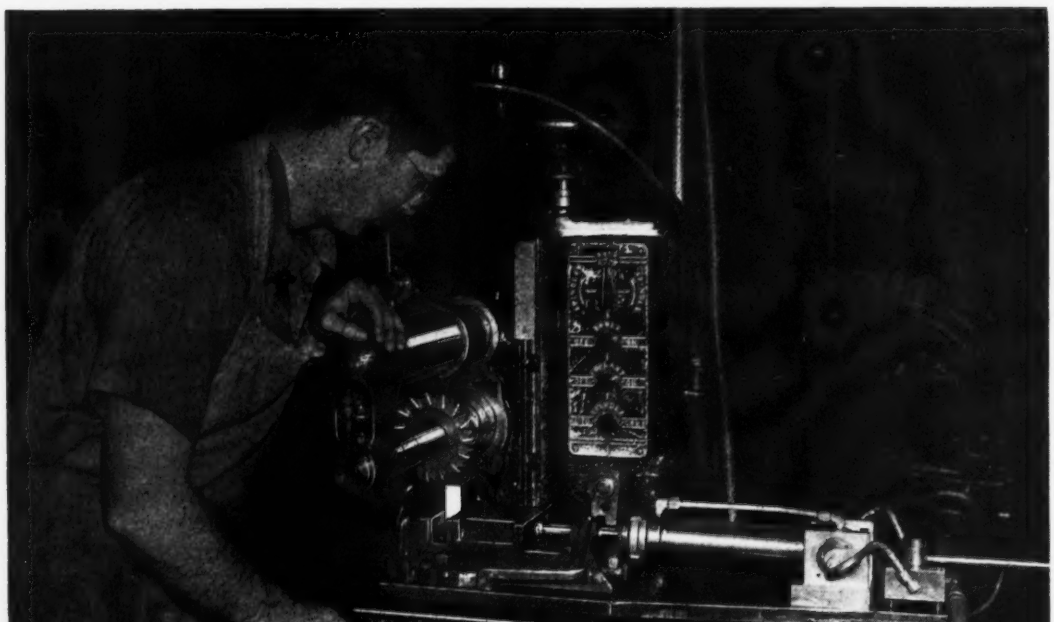


*Fig. 1. Pneumatic Equipment Salvaged from Scrap Parts has been Substituted for the Regular Clamping Screw of the Vise on This Milling Machine*

METHODS developed in the Texas plant of North American Aviation, Inc., to enable unskilled help to turn out accurate airplane parts as efficiently as skilled help were described in an article in July, 1942, MACHINERY. The present article describes additional operations in the same plant.

An air-operated vise that speeds up the clamping of work on a Sundstrand milling machine is illustrated in Fig. 1. The operating mechanism of this vise was built up entirely from scrapped airplane parts so that its cost was practically nothing. For example, it is operated by a rejected retraction cylinder. The vise jaws are opened and closed instantly by turning a valve handle, which saves considerable time, as compared with the previous method of tightening and loosening the clamping screw that originally came with the vise.

Landing gear oleo knuckles are bored to a close tolerance on the Ex-Cell-O precision boring machine shown in Fig. 2, which is equipped with boring-bars of a special type designed by the machine shop foreman. The feature of these boring-bars is that the cutters are held in a slot which extends right through the center of the bar. Tools are changed by merely slipping them sidewise into the end of the bar, and no adjustments are ever necessary on the boring-bar itself. For this reason, long life of the boring-bar has been effected. One cutter on each of the bars in the operation shown bores the part for a length of about 1 1/2 inches. The other cutter on the same bar chamfers the outer end of the hole.

Similar bores are machined on opposite sides of the piece, which is an aluminum-alloy casting. The cutters are run at 4000 R.P.M., and

*Fig. 2. Boring Two Holes on Opposite Sides of Landing Gear Oleo Knuckles in Close Alignment by the Use of Special Boring-bars*

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the feed of the work past the cutters is about 5 inches a minute. The depth of the cut in boring is approximately 1/8 inch on a side.

Centerless grinding is employed to finish the 39-inch long seat-supporting tubes seen in Fig. 3, ready for chromium plating. These tubes are 1 inch in diameter and have a series of small holes drilled near the center. Because of these holes, each tube is plugged shut with a cork at the front end before the tube is passed through the machine. This prevents coolant from entering through the drilled holes and flowing through the tube to the front end and falling on the floor. Hydraulic pistons are ground externally on machines of this type to specified diameters within plus 0.0005 inch, minus nothing.

Various devices have been developed to facilitate the holding of heavy and awkward work in spot-welding operations. In Fig. 4, for example, is seen a sling for supporting the large removable side panel of fuselages, which enables spot-welding to be accomplished by one man only. Before this sling was designed, several men were necessary to manipulate the piece beneath the electrode.

Suspended from the ceiling is a track that extends at an angle past the front of the ma-

*Fig. 3. Typical Operation Performed on Centerless Grinding Machine. The Operation Shown Merely Prepares the Tubes for Chromium Plating, but in Some Cases, Parts are Ground within a Total Tolerance of 0.0005 Inch*

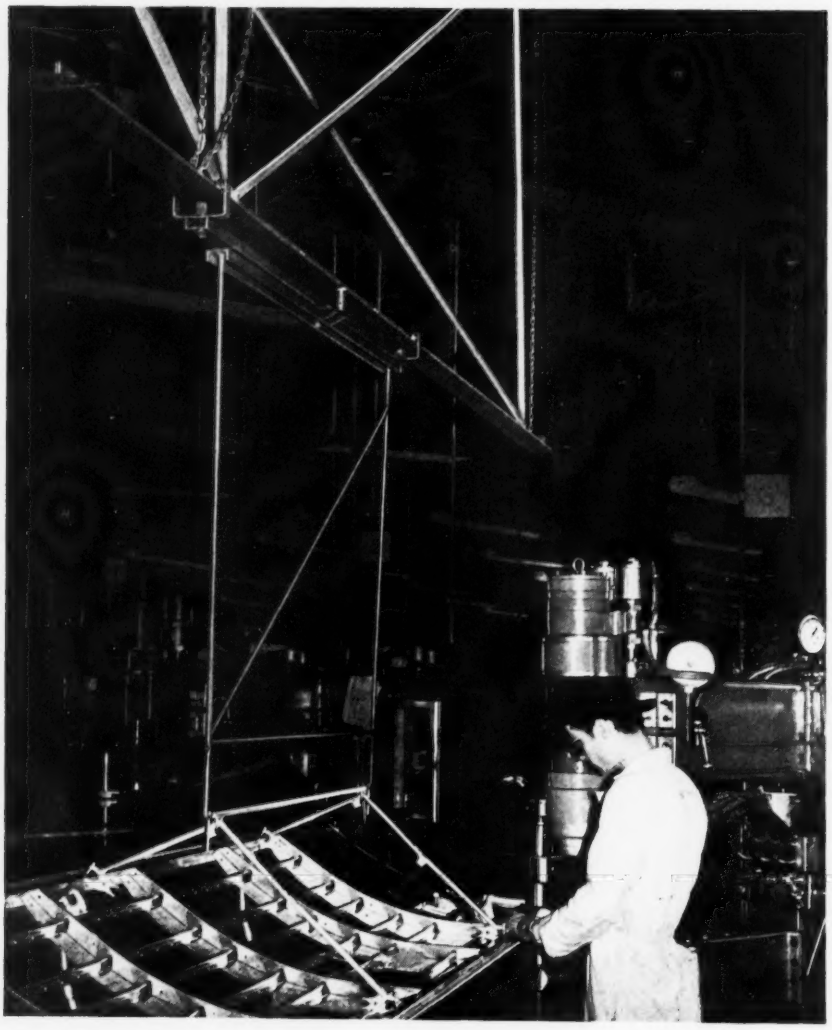

*Fig. 4. Spot-welding Operations have been Made Easier by the Use of Various Means of Suspending the Work from Overhead, thus Eliminating the Need of Men for Holding the Work*

chine. Mounted on this track is a structural carriage that supports a hanger constructed of horizontal and vertical rods and bars. The lower ends of the vertical rods are provided with holes to receive the ends of a horizontal bar on which links are mounted that are attached to the work for holding it horizontal. The central links of the two pairs pass through eyes on this horizontal bar.

The arrangement is such that the side of the work that is nearest to the machine is always held in a horizontal plane and at the required height for convenient welding. The hanger swivels on the overhead carriage so as to enable either side of the work to be presented to the machine.

Several pairs of links are furnished, so that they can be clamped on work while an operation is in progress, and then quickly attached to the hanger without tying up production.

## Water-Cooled Brazing Tongs Built up from Pliers

One of the new types of equipment developed at the General Electric Co.'s Schenectady Works to meet production requirements with silver brazing, which is in greatly increased use due to the shortage of tin for soldering, is a pair of water-cooled tongs built up from a pair of 8-inch parallel flat-nose pliers. The tongs are used as carbon-holders in the incandescent carbon process of silver brazing, and are cool, light, and efficient in operation.

The tongs are easy to make. Steel blocks are first welded to the plier jaws to give them an outside width of 1 1/2 inches when closed. These blocks are then drilled and tapped for 3/8-inch bolts. Bar copper of varying dimensions is bent to fit the clearances required for the particular job to be handled, and the tips are cut to hold small blocks of carbon. The bars are drilled and tapped to accommodate 1/4-inch pipe fittings by means of which water-cooled power leads are attached. A rubber-hose jumper forms a water connection between the jaws, and additional water carriers may be drilled the entire length of the bars if necessary. Mica sheets and bushings are employed for insulation between the parts and the pliers.

A single-loop pronged spring, of 0.091-inch wire, welded at one end and free at the other between the handles of the pliers, provides sufficient force to open the jaws when the braze is completed.

* * *

## Tool Salvage by Chromium Plating

It is possible to extend the life of many cutting tools by hard chromium plating. The procedure is not new, but has been improved considerably in the last few years. This method of salvage has not been used much in the past because the need for it was not so great. With the present scarcity of tools, however, the process is likely to be seriously considered.

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# MACHINERY'S DATA SHEETS 491 and 492

## PROPERTIES OF MONEL PRODUCTS

| Monel Product | Tensile Strength, Pounds per Square Inch | Yield Strength, 0.2 Per Cent Offset, Pounds per Square Inch | Proportional Limit, 0.00 Per Cent Offset, Pounds per Square Inch | Elongation in 2 Inches, Per Cent | Impact Strength, Foot-pounds (Izod) | Brinell Hardness, 10-mm. Ball, 3000 kg. |
|---|---|---|---|---|---|---|
| **Rod and bar** | | | | | | |
| Cold-drawn | | | | | | |
| Annealed | 70,000– 85,000 | 30,000– 40,000 | 20,000–30,000 | 50–35 | 120–90 | 110–140 |
| As drawn | 85,000–125,000 | 60,000– 95,000 | 45,000–75,000 | 35–15 | 115–75 | 160–250 |
| Hot-rolled | 80,000– 95,000 | 40,000– 65,000 | 25,000–40,000 | 45–30 | 120–75 | 140–185 |
| Forged | 80,000–110,000 | 40,000– 85,000 | 25,000–65,000 | 40–20 | 115–75 | 140–220 |
| **Wire, cold-drawn** | | | | | | |
| Annealed | 70,000– 85,000 | 30,000– 40,000 | ..... | 50–35 | ..... | ..... |
| No. 1 temper | 95,000–110,000 | 65,000– 85,000 | ..... | 10– 5 | ..... | ..... |
| Regular | 110,000–140,000 | 85,000–100,000 | ..... | 8– 4 | ..... | ..... |
| Spring | 140,000–170,000 | 100,000–130,000 | ..... | 10– 2 | ..... | ..... |
| **Plate, hot-rolled** | | | | | | |
| Annealed | 70,000– 85,000 | 30,000– 45,000 | 20,000–30,000 | 50–30 | ..... | 110–140 |
| As rolled | 80,000–110,000 | 40,000– 90,000 | 25,000–70,000 | 45–20 | ..... | 140–220 |
| **Sheet and strip** | | | | | | |
| Standard cold-rolled sheet and plate | 65,000– 80,000 | 25,000– 35,000 | ..... | 40–20 | ..... | 60– 68* |
| Special cold-rolled | | | | | | |
| Annealed | 65,000– 80,000 | 25,000– 35,000 | ..... | 40–20 | ..... | 60– 68* |
| No. 35 sheet | 78,000– 85,000 | 45,000– 65,000 | ..... | 40–20 | ..... | 74– 89* |
| Full-hard sheet | 100,000–120,000 | 90,000–110,000 | ..... | 3– 2 | ..... | 98 min.* |
| Full-hard strip | 100,000–130,000 | 90,000–115,000 | ..... | 15– 2 | ..... | 98 min.* |
| **Tubing, cold-drawn** | | | | | | |
| Annealed | 65,000– 85,000 | 25,000– 35,000 | ..... | 35–20 | ..... | 55– 70* |
| As drawn | 90,000–105,000 | 60,000– 75,000 | ..... | 20–10 | ..... | 90–105* |
| **Castings** | | | | | | |
| Monel | 65,000– 80,000 | 32,500– 40,000 | ..... | 45–25 | 80–65 | 125–150 |
| "S" Monel | 90,000–115,000 | 70,000– 90,000 | ..... | 3– 1 | 5– 1 | 275–350 |

*Rockwell B Scale

**MACHINERY'S Data Sheet No. 491, June, 1943**

Compiled by the International Nickel Co., Inc., New York

## CHARACTERISTICS AND PROPERTIES OF NICKEL AND MONEL AND INCONEL ALLOYS

| | Individual Characteristics | Average Mechanical Properties | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Condition | | Tensile Strength, Pounds per Square Inch | Yield Strength, Pounds per Square Inch | Elongation in 2 Inches, Per Cent | Brinell Hardness (3000 kg.) | Impact Strength, Foot-pounds (Izod) |
| ***Monel*** Two-thirds nickel One-third copper | *General-Purpose Alloy* Corrosion Resistance, Strength Hardness, Toughness Attractive Silvery White Color | Annealed | | 75,000 | 35,000 | 40 | 125 | 105 |
| | | Hot-rolled | | 90,000 | 50,000 | 35 | 150 | 110 |
| | | Cold-drawn | | 100,000 | 80,000 | 25 | 190 | 95 |
| | | Cold-rolled, hard-temper | | 110,000 | 100,000 | 5 | 240 | ... |
| ***"R" Monel*** Contains the addition of 0.035 per cent sulphur | *Free-Cutting* For High-speed Machining | Hot-rolled | | 85,000 | 45,000 | 35 | 145 | 96 |
| | | Cold-drawn | | 90,000 | 75,000 | 25 | 180 | 99 |
| ***"K" Monel*** Contains the addition of 2.75 per cent aluminum | *Extra Strength and Hardness (comparable to heat-treated alloy steel)* Heat-treatable Non-magnetic | Hot-rolled | As rolled | 100,000 | 45,000 | 40 | 160 | 120 + |
| | | | Heat-treated | 150,000 | 110,000 | 25 | 280 | 40 |
| | | Cold-drawn | As drawn | 115,000 | 85,000 | 25 | 210 | 56 |
| | | | Heat-treated | 155,000 | 115,000 | 20 | 290 | 26 |
| ***"KR" Monel*** | *Free-Cutting* Extra Strength and Hardness Heat-treatable Non-magnetic | Hot-rolled | As rolled | 105,000 | 65,000 | 40 | 185 | ... |
| | | | Heat-treated | 150,000 | 105,000 | 25 | 280 | ... |
| | | Cold-drawn | As drawn | 115,000 | 85,000 | 25 | 215 | ... |
| | | | Heat-treated | 155,000 | 115,000 | 25 | 290 | ... |
| ***"S" Monel*** Contains the addition of 4 per cent silicon | *Extra Hardness at High Temperatures* Non-galling | Sand-cast | Annealed | 90,000 | 70,000 | 3 | 275 | ... |
| | | | As cast | 130,000 | 100,000 | 2 | 320 | ... |
| | | | Heat-treated | 130,000 | 100,000 | 2 | 350 | ... |
| ***Nickel*** 99.4 per cent nickel | *Corrosion Resistance* Protection for Pure Products Magnetic below 680 Deg. F. Good Electrical Conductivity | Annealed | | 70,000 | 20,000 | 40 | 100 | 120 + |
| | | Hot-rolled | | 75,000 | 25,000 | 40 | 110 | 120 + |
| | | Cold-drawn | | 95,000 | 70,000 | 25 | 170 | 120 + |
| | | Cold-rolled, hard-temper | | 105,000 | 95,000 | 5 | 210 | ... |
| ***"Z" Nickel*** 98 per cent nickel | *Extra Strength and Hardness* Heat-treatable Excellent Spring Properties Good Electrical Conductivity Magnetic | Hot-rolled | As rolled | 105,000 | 50,000 | 35 | 180 | 120 + |
| | | | Heat-treated | 170,000 | 130,000 | 15 | 320 | 25 |
| | | Cold-drawn | As drawn | 120,000 | 90,000 | 25 | 220 | 120 + |
| | | | Heat-treated | 175,000 | 135,000 | 15 | 340 | 25 |
| ***Inconel*** 80 per cent nickel 14 per cent chromium Balance, iron | *Heat Resistance* Retains Strength Resists Oxidation High Corrosion Resistance Non-magnetic | Annealed | | 85,000 | 35,000 | 45 | 150 | 120 + |
| | | Hot-rolled | | 100,000 | 60,000 | 35 | 180 | 110 |
| | | Cold-drawn | | 115,000 | 90,000 | 30 | 200 | 85 |
| | | Cold-rolled, hard-temper | | 135,000 | 110,000 | 5 | 260 | ... |

**MACHINERY'S Data Sheet No. 492, June, 1943**

Compiled by the International Nickel Co., Inc., New York

# How to Secure Fine Surfaces by Grinding

By H. J. WILLS, Engineer
The Carborundum Co., Niagara Falls, N. Y.

**Third of a Series of Articles Describing the Factors Governing Fine Surface Quality and the Means by which This Quality Can be Obtained**

IN the first two articles of this series the general factors affecting fine surface quality and the points that should be watched when such quality is to be obtained by grinding were discussed. This article will take up the selection of the right type of grinding wheels for producing fine surface quality on different materials.

Many surface faults which are intolerable on work that must have a fine surface are due to trying to use a wheel that is poorly adapted to the job. It is true that an experienced, skillful grinding machine operator can, by manipulating the various speeds and feeds, make a wheel do a job that it was not intended for. He can, for instance, make a wheel that is of too hard a grade, act softer; or one that is too soft, act harder. Such a procedure is sometimes necessary in a shop that has a considerable variety of work in small lots, making it impractical to carry a stock of all wheels of the exact specifications needed.

Fine finishes can be secured in this way—but always at the cost of slower production. Furthermore, a wheel can be manipulated to the extent needed only on a hand-operated machine. Automatic and semi-automatic machines, which are apt to be the rule in production shops, do not lend themselves well to wheel manipulation.

In armament shops, where high rates of production, combined with fine surface qualities, are essential, it is mandatory to select as nearly as possible the ideal wheel for each job, to standardize the operations as to speeds and feeds, and to maintain the machines in such excellent condition that the wheels will grind continuously in the proper manner without manipulation.

### *When are Wheels "Self-Sharpening"?*

It is often said that a wheel which is perfectly suited to a job will be "self-sharpening." This means that the surface grains of abrasive will continue to be held by the bond so long as they are sharp enough to cut satisfactorily, but that when they become dull, they will be torn from the bond, leaving new, sharp grains to be presented to the work.

This characteristic of a perfect wheel depends upon the ease or difficulty with which the abrasive grains fracture, and the ease or difficulty with which they can be torn from the bond. Both of these conditions, in turn, depend not only upon the brittleness or toughness of the abrasive and the grade of the wheel, but also upon the characteristics of the work material and the stresses set up in the wheel by the grinding operation. How to manipulate a not-quite-right wheel to do a job for which it is not perfectly suited will be discussed in the next article of this series.

In fine grinding on a high-production basis, wheels are never completely or even adequately self-sharpening in the semi-finishing and finishing operations, although they often are in the rough-grinding. This is because only small amounts of material are removed in the final operations, using a slow traverse, so that the stresses set up are not sufficient to break the crystals and tear them out quickly enough. It is, therefore, necessary to sharpen the wheel with a dressing tool. This procedure, as used in fine grinding, will be described in a later article.

### *Dressing the Wheel for Fine Grinding*

If the grinding machine is in top-notch condition and the wheel well suited to the job, it is often possible to rough- and finish-grind a piece to within 5 or 6 micro-inches r.m.s. surface roughness with a single wheel. For the rough grind, the diamond dressing tool is traversed rapidly, to give an open pattern to the wheel face. This will make the wheel act coarser than it really is, so that it will remove stock rapidly, but the finish will be comparatively poor.

The wheel is then diamond-dressed with a slow traverse and slight in-feed. The stock removal with a wheel so dressed will be slow, but there should be little stock removal on a finish grind anyway. The finish given the work will be similar to that expected from a wheel of two or three grit sizes finer.

For extremely fine surfaces of, say, 2 micro-

inches r.m.s. or less, it is necessary to use two, three, or even four wheels successively, each of finer grit than the one used for the preceding operation. Each wheel is used as both a roughing and finishing wheel by allowing it to spark out and by dressing it as for single-wheel operation. If very fine surfaces are required, the work speed and rate of traverse should be reduced during the finish-grind operation. Generally speaking, the less the stock removed by each wheel, the better will be the surface generated.

If only one machine is available, the use of several wheels slows up production considerably, owing to the time required for changing wheels. But if two or more machines can be assigned to the job, one for each operation, no wheel changes will be necessary. Incidentally, if it is necessary to use a machine that is not in the best of condition, it should be assigned to the roughing operation. Moderate defects in surface quality are not objectionable in roughing, as the marks will be removed in the later operations.

### *Choosing the Correct Abrasive*

In selecting a wheel, it is necessary to decide upon the kind of abrasive to use, the grain size, the spacing of the grains (structure), the type of bond, and the grade (bond hardness).

Aluminum oxide is the toughest, least readily fractured abrasive, and therefore should be used for grinding tough materials of high tensile strength, such as carbon, alloy, and high-speed steels, annealed malleable iron, and tough bronze.

Silicon carbide is harder than aluminum oxide, but its crystals fracture more easily. Because of its hardness it is used for grinding such hard materials as gray and chilled irons, very hard alloys, and the cemented carbides. On the other hand, it is also used for the very soft materials such as aluminum, copper, brass, and soft bronze, whose tensile strength is too slight to fracture the tough aluminum-oxide crystals.

Generating fine surfaces on tough materials at one time presented quite a problem, since to obtain such surfaces it is essential to take very light finishing cuts. For ordinary cuts, aluminum oxide would be indicated, but the light in-feeds required do not set up sufficient stress to fracture the crystals.

A way was found, however, to modify the method of making aluminum oxide so that the crystals would break more easily than those of regular aluminum oxide, but not so readily as those of silicon carbide. The desired free-cutting action is thus obtained without excessive wheel wear. This special aluminum oxide is now much used in fine grinding.

One of the special, friable aluminum-oxide abrasive wheels is also often desirable when the wheel and work are both of large diameter. The area of contact is then large, so that the stresses per unit area are small—often too small to break the crystals of regular aluminum oxide.

### *Grain Size Should be Relatively Small*

For fine grinding, the size of the abrasive grains should range from 80 to 600 for all except the first rough grind. The finer the grain, the smoother the surface, because the grit marks are shallower and closer together. Also, because the grains are closer together and smaller, the heat generated by the cut is reduced, and surface faults caused by burning are often eliminated.

Fine-grain wheels often actually reduce the time required to produce the desired surface, even though a wheel of larger grain size removes material more rapidly. A case illustrating this point is that of a shop which turned out certain armament parts of large size that required a very fine surface. This shop started out by doing the obvious thing—using coarse grit wheels for the roughing operation, with the expectation that production would be increased by the heavier cut that could be taken.

The surface left after the roughing operation was so poor, however, that an undue number of subsequent operations were needed to remove the grain marks. Under pressure to speed production, the shop consulted one of our engineers. He advised doing the roughing with an 80-grit wheel. It took somewhat longer for the roughing, but two additional operations were eliminated, due to the smaller grit marks left by the finer roughing wheel. The job is now done in one roughing and one finishing operation, the total time being reduced and satisfactory surface qualities obtained.

Selecting a wheel of the correct structure is essential. Wheels are made of various structures, ranging from open to close. In an open-structure wheel, the grains are more or less widely spaced, with comparatively large voids between them. These are sometimes called porous wheels, while those with small voids and with grains close together are often called dense.

For fine grinding, close structure is desirable, since the smaller distance between grains makes the distance between the hills and valleys on the surface less. The closer these are together, the better the surface quality, as far as roughness is concerned.

The bond which holds the abrasive grains in the wheel may be any of five types—vitrified, resinoid, shellac, rubber, or silicate of soda. Of these, vitrified and resinoid are most commonly used in fine grinding. Vitrified wheels give excellent surfaces, but when an exceptionally

smooth surface is required resinoid is usually the choice.

Probably the most common mistake in selecting wheels for fine grinding is in choosing wheels of the wrong grade. Grade, or bond hardness, is the resistance that the bond puts up against the stresses tending to tear the grains from the bond. If the grains are easily torn out before they are dull, the wheel is said to be soft. If the bond holds the grains tenaciously after they are dull, it is said to be hard.

### *Selecting the Right Bond Hardness*

It is not possible to lay down hard and fast rules for selecting the right grade of wheels to be used for fine grinding. Only tests made under actual shop conditions on the machine in which the wheel will be used are trustworthy guides in arriving at this important decision. A competent abrasive engineer who knows all the conditions can usually recommend a wheel close to the right grade, so that only a few wheels need be tested.

In general, the rules are: Use a wheel of hard grade for a soft material, because a soft material does not dull the abrasive grains quickly, and it is therefore economical to keep the grains in the wheel as long as possible—up to the point where they have ceased to be useful. Use a soft-grade wheel for the hard materials, because the grains are dulled quickly and should be torn from the bond as soon as they become dull.

The greater the stresses set up by the grinding operation, the harder should the grade be. Therefore, the general rule is to use hard grades when the area of contact between the wheel and the work is small, when the ratio of work speed to wheel speed is high, when the traverse is rapid, and the in-feed large.

If the grinding machine is heavy, rigid, and in good condition a softer wheel can be used than when the machine vibrates or the spindle is loose.

If a wheel is too hard for the job, it will load or glaze and the work will be marked with chatter marks that are fairly long, wide, and evenly spaced at wide intervals. The work may also be discolored and burned. A loaded or glazed wheel will not cut as rapidly as it should.

These faults may be due to a correct wheel being operated under conditions that make it act harder than it is, in which event it is necessary to change the operating conditions as will be described in the next article. If the wheel is actually too hard, the trouble can be corrected by substituting a softer wheel or one of more open structure or coarser grit. However, in producing fine surfaces, as we have seen, open structure and coarse grits are usually undesirable, so the cure usually is to substitute a softer grade of wheel.

Grit marks on the work may be caused by a wheel that is too coarse or too soft, in which event a finer, harder wheel should be used. Another cause may be that there is too much difference in the grit sizes between the roughing and the finishing wheels. The cure is to use a finer roughing wheel or to finish out better with the roughing wheel. Sometimes the wheel is not to blame for grit marks on the work, the trouble being that the wheel has been dressed too coarsely. In such cases, use less penetration of the dressing tool and traverse more slowly when dressing.

Another cause of grit marks may be dirty coolant. Coolants used in fine grinding should always be filtered.

The next article will discuss the manipulation of wheels in order to get the best results in fine grinding with a wheel that is correct, and will also describe how to get better results with a wheel that is not the correct one for the job.

* * *

## Making Gear Pinions by a Coining Process

At the recent meeting of the American Society of Tool Engineers in Milwaukee, Wis., R. J. Goldie, vice-president of the Timken-Detroit Axle Co., explained a method that is being used by his company for producing automotive pinions. The method was adopted because of the long deliveries required in obtaining gear-generating machines.

In the new method, the gears are hot-forged to finished shape from steel blanks, including the gear teeth. The only major machining required is the drilling and reaming of the bore and the facing of the back face of these bevel pinions. It is claimed that the teeth are accurate within a tolerance of 0.001 inch. By this method, 320 bevel gear pinions are produced an hour on a press that cost $40,000. For the same production, the speaker said, nineteen generating machines, at a cost of approximately $200,000, would have been required.

An interesting item mentioned by Mr. Goldie in this connection is that the finish-forged pinions weigh considerably more than machined gears of exactly the same dimensions and material, indicating that the forging process results in a closer grain structure.

* * *

According to the American Gear Manufacturers Association, new orders for gearing booked in March, the last month for which complete figures are available, showed an increase of 10.5 per cent over the business booked in February. This does not include turbine or propulsion gearing.

# Materials of Industry

## THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

### Building-Up Material for Wooden Patterns

A colloid-treated fabric known as "Celastic" for building up the surfaces of wooden patterns has been introduced on the market by the Celastic Corporation, 626 Schuyler Ave., Arlington, N. J. It consists of a napped cotton flannel impregnated with pyroxylin and a fire-retardant. The material can be cut in any shape desired and the edge skived to a feather edge. When immersed in a solvent, it becomes flaccid and sticky, and can be readily applied.

After evaporation of the solvent, it becomes relatively hard, and may be lightly sanded and shellacked to a smooth surface. When so treated, it will withstand the action of the molding sand very well. Removal of the material can be accomplished by a reapplication of the solvent..201

### Flux for Use in Gas-Welding Magnesium

A flux for use in gas-welding magnesium is now being manufactured by Park Stewart, 1039 Carbis St., Worthington, Pa. This new flux, known as "Mag-Na-Flo" flux, is suitable for gas-welding all alloys of magnesium, whether in sheet or extrusion form. The flux is mixed to a thin paste by slowly pouring it into water while stirring, and is applied on the metal to be welded with a small brush. The welding wire may also be coated by dipping it into a tube of the dissolved flux. ..... 202

### Fabric Substitute for Rubber and Leather

A multi-ply fabric known as "Cottonleather," which is chemically treated to increase its density and durability, and surface-treated to give it a flexible leather-like nature, has been developed by the Southern Friction Materials Co., Charlotte, N. C., as a substitute for rubber and leather. This fabric is expected to be used in such applications as facing belt-driven pulleys, pipe, and hose clamps where metal is objectionable, and shock-absorbing blocks, heavy shim stock, and anti-squeak webbing. It is available in the form of planks, strips, and rolls.....203

### Temperature-Indicating Compound in Liquid Form

An emulsified compound known as "Tempilaq," which dries immediately upon application and melts when a stated temperature is reached, is a recent product of the Tempil Corporation, 132 W. 22nd St., New York City. This temperature indicator works equally well on metal, glass, ceramic, plastic, or wood surfaces. It has been developed especially for use on polished surfaces, on the inside of tubes or castings, and on other inaccessible places such as overhead surfaces. The new compound is available in a range of compositions for indicating any temperature from 125 to 350 degrees F. in 25-degree intervals, and from 350 to 1600 degrees F. in 50-degree intervals. .....204

### New Manganese Alloy for Electrical Use

A new manganese-base alloy containing over 70 per cent manganese has been recently brought out by the W. M. Chace Co., 1600 Beard Ave., Detroit, Mich. This high manganese-content alloy, known as Chace manganese alloy No. 772, has distinctive physical properties made possible by the use of electrolytic manganese of a purity greater than 99.9 per cent.

This alloy has an electrical resistance of 1050 ohms per circular mil foot, which is about 60 per cent higher than that of most resistance alloys in common use. Its thermal expansion rate is considerably higher than that of any other strong alloy, being about twice as high as for steel. Its vibration damping constant is 2.3 per cent, compared with 0.01 per cent for hardened steel. The thermal conductivity of this alloy is exceptionally low, being only 2 per cent that of copper. The new alloy is expected to find many applications in the field of temperature-actuated electrical controlling devices..205



To obtain additional information about materials described on this page, see lower part of page 180.

## Protective Compound for Weld Spatter

A compound has recently been developed to prevent the adherence of weld spatter to metal areas surrounding welds by the Wolfe-Kote Co., Sheboygan, Wis. When this compound, called "Anti-Spatter," is applied to the metal surfaces, no fusion of weld spatter occurs. The excess metal can simply be wiped off with a dry rag; if the weld is to be painted, a wet rag or the usual degreasing procedure may be employed. The compound is non-inflammable, non-toxic, and has no injurious effect on metals. It is also claimed that practically all weld rust is eliminated by its use. . . . . 206

## Insoluble Alkali Silicate Finish for Metal Products

A coating for metal products, known as "Armor-Vit," has recently been developed by the Chicago Vitreous Enamel Products Co., Cicero, Ill. It is essentially an alkali alumina silicate, one source of which is a new ingredient —an oil-bearing halloysite.

Armor-Vit is applied in either one or two coats of 0.0005 to 0.0010 inch thick. A curing treatment (best accomplished in an indirect-fired, air-circulating oven with proper temperature control, and capable of heating to 750 to 800 degrees F.) combines the ingredients of the coating into a hard, heat-resisting finish. This finish is insoluble in boiling water and highly resistant to such acids as acetic, sulphuric, nitric, and hydrochloric, and also to cold, concentrated caustic soda, ethyl alcohol, toluene, ether, sodium chloride solution, calcium chloride solution, ammonium hydroxide, etc.

Impact and abrasion are well withstood by this new finish, and it has shown high heat resistance and ability to withstand thermal shock. It has been heated to 1200 degrees F. and then quenched in cold water without failure of the coating. . . . . 207

## Silver Alloy Brazing Flux with Improved Characteristics

A silver alloy brazing flux, known as "Scal-flux 21," has been placed on the market by the Scaife Co., Oakmont, Pa. It is stated that this flux speeds production, reduces costs, simplifies silver alloy brazing, and is adapted for brazing any type of ferrous or non-ferrous alloys. The improved characteristics are due largely to the low melting point of the flux and its low surface tension. . . . . 208

## Durez Casting Resin for Dies and Jigs

A phenolic casting resin for metal-forming dies, jigs, fixtures, etc., called Durez 7421 liquid resin, has been placed on the market by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. This resin is readily cast at room temperatures through the use of an accelerator. The cast product has the following properties: Compressive strength, 15,000 to 20,000 pounds per square inch; impact strength, 0.11 to 0.15 Izod; flexural strength, 7000 to 9000 pounds per square inch; modulus of elasticity (in bending) 500,000.

Durez 7421 liquid resin is a thermosetting material that sets by baking at temperatures above 100 degrees C. By using an accelerator, castings can be made at lower temperatures. Baking for two to four hours at 140 degrees F. is standard procedure. . . . . 209

This Cast Durez Resin Drill Jig is Used in the Production of Aerial Delivery Containers by Aviation Engineering, Inc. It was Cast Directly from One of the Containers, Assuring an Exact Contour. The Holes for Locating Bushings were Drilled, and These Bushings are Held in Place by Cerrobend Alloy. A Metal Cross-bar Serves as Reinforcement and Guide

To obtain additional information about materials described on this page, see lower part of page 180.

# Welding Methods for National Emergency Steels

By A. N. KUGLER, Applied Engineering Department
Air Reduction Sales Co., New York City

SINCE the introduction of the National Emergency or NE steels, there has been much discussion concerning the working of these steels. Little has been said, however, on the welding procedures for these steels—perhaps because it was generally understood that the welding of NE steels presents no new or unusual problems. Nevertheless, questions on this subject occasionally arise, indicating that some doubt exists concerning the procedure to follow.

Since these steels differ from standard alloy steels chiefly in the amounts of alloying elements present, and since the effect upon weldability of each constituent is fairly definitely known, one of the established welding procedures is suitable for welding these steels.

The basis for the procedure is, of course, the carbon content and hardenability, as governed by the amounts of other hardening elements present. The welding procedure will be further influenced by the section of the fabricated piece —whether it is light-gage material or of heavy thickness. Likewise, the selection of the filler metal is affected by the physical characteristics required in the weld or the service to which it will be put. Thus, a low-carbon alloy-steel rod is called for when ductility is most important, and a higher carbon filler metal is used when hardness and wear resistance are required, or when the part is to be flame-hardened.

While the foregoing statements are quite general and are in no way out of the ordinary, they serve to accentuate the fact that these steels are readily weldable by ordinary procedures. In those cases where the NE steel is similar in composition to the original alloy steel that it replaces, it is usually possible to use the same procedure and the same welding rod or electrode.

Bearing in mind the differences in procedure dictated by the size of the weld and the ultimate service, certain general recommendations may be made by classifying the emergency steels into groups. At the top of the list, those with low carbon content may be welded with standard low-carbon alloy steel rod or electrodes. The medium-carbon steels may be welded with the same filler metal, but better physical properties are obtained by using rods of higher carbon and manganese content. The higher carbon steels may be welded with a standard 0.15 carbon nickel-chromium rod or a standard electrode.

Since virtually all these alloys having more than 0.30 carbon are air-hardening steels, care must be taken, when welding with the oxy-acetylene flame, to use the "back-hand" technique to keep the puddle constantly protected by the flame and the flame streamer. A flame with a slight excess of acetylene should also be used on the higher carbon steels, and care should be taken to eliminate turbulence.

# Cemented-Carbide Dies for Drawing Steel Cartridge Cases

WITH the conversion from brass to steel for cartridge cases ranging from 20 up to 105 millimeters, the use of cemented-carbide drawing dies has become generally accepted practice. Carbide dies were used extensively for drawing brass cases because of their longer life and lower cost per piece produced; with the advent of steel cases, carbide dies became a necessity.

The use of carbide dies for steel cartridge cases did not present any unusual die-manufacturing problem, since the dies used do not differ a great deal from the carbide dies employed for drawing steel tubing. These have been used successfully for that purpose for several years. The main difference between most cartridge-case drawing dies and steel-tube dies is the provision of a guide ring plate on the cartridge-case die to guide the case into the die. In drawing steel tubing, the end of the tube is pointed, so as to feed readily into the die without requiring a guide. The Carboloy Company, Inc., Detroit, Mich., has prepared detailed instructions for the use and maintenance of cemented-carbide dies for drawing steel cartridge cases.

* * *

Shop managers frequently complain of systematic efforts to slow down production. Considering the serious dangers facing this nation, it is difficult to understand how any group of men can deliberately pursue a policy of encouraging the workers to do less than that of which they are capable. Many workers resent the pressure that is brought to bear upon them, but as individuals they are helpless. More publicity of specific cases and an aroused public opinion are needed.

# A Problem in Absenteeism

ONE of the difficulties with regard to absenteeism in some industries arises from the fact that it is hard for the employes to understand why a plant should operate at full speed for, say, three days and then shut down on the fourth. Naturally, a man will ask "Why should I be so conscientious about not taking a day off when the company can afford to shut down the plant right in the middle of a job?"

In order to explain the reasons for such temporary shut-downs to the employes, E. F. Fisher, general manager of the Fisher Body Division of General Motors, recently spoke to the employes of that organization on the subject. He said: "It certainly does not appear on the surface to be efficient operation to work long hours of overtime and on Sundays and holidays, and then close down for a day or two waiting for materials or in order to make necessary tool changes. Unless all the facts are known, these conditions may easily be interpreted as managerial blunders, poor planning, or even governmental inefficiency. It should be understood, however, that we cannot operate in wartime on the 'steady flow' basis to which we were accustomed in peacetime.

"Frequently engineering changes are required immediately to meet the continually changing conditions on the fighting fronts. Often material must be quickly transferred to other—and for the time being—more important projects. That is war. That is what we are all up against."

Mr. Fisher then asked the workers to bear these conditions in mind and to be on the job every day that their services are required for producing all that is necessary to the soldiers at the front.

# High-Speed Steel Tipped Tools at General Electric

THE need for conserving high-speed steel has led to the furnace brazing and hardening of high-speed steel tipped tools at the General Electric Co.'s Schenectady works. The tool blank is first rough-machined, and the part that is to fit the tip is ground. The high-speed steel tool tip is also ground to fit the shank recess. The tip is then nickel-plated and a copper shim, 0.005 inch thick, is inserted between the shank and the tip. The tip is held in place by a piece of chromium-nickel wire. After both tip and shank have been covered with a flux, the tool is ready for brazing and hardening. This is done in a controlled-atmosphere electric furnace using drycolene, a gas developed for use in heat-treating furnaces. Steel that has been treated in this gas is free from decarburization and oxidation.

The brazing and hardening are done at the same temperature. The tool is put into the furnace without preheating. It is kept in the furnace long enough to become heated to a temperature of 2375 degrees F., if made from tungsten high-speed steel. If made from molybdenum high-speed steel, a temperature of 2250 degrees F. is used. The tool is then carefully removed from the furnace, so as not to disturb the tip, and is quenched in oil till it turns black—approximately at 1100 degrees F.—after which it is cooled in still air. Next the tool is drawn or tempered for two hours at 1050 degrees F., air-cooled, retempered for one hour at 1050 degrees F., and then again air-cooled. Finally, it is finish-ground.

Tests of high-speed steel tips treated in this manner indicate a hardness of from 64 to 65 on the Rockwell C scale.

* * *

### What a Spoiled Part Means

In the plant of the Warner & Swasey Co., Cleveland, Ohio, posters are used to impress on the workers the seriousness of spoiled work. This Warner & Swasey poster was selected at the recent Production Poster Exhibit at the War Congress of American Industry, held in New York City, as one of the outstanding posters out of 750 entries.

The poster shows in ten pictures the processes that a part scrapped because of careless handling in grinding actually has passed through: (1) The ore must be mined; (2) the ore must be shipped to a blast furnace; (3) it must be refined in the blast furnace; (4) an open-hearth furnace turns it into steel; (5) the steel ingots are rolled into bar stock; (6) the bar stock is delivered to the manufacturing plant for final machining; (7) it is turned in a turret lathe; (8) splines are milled in it; (9) it is heat-treated; (10) it is finally ground—and a mistake in the grinding operation makes worthless all the previous steps.

# New Trade Literature

## RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

*To Obtain Copies, Fill in on Form at Bottom of Page 179 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the June Number of MACHINERY*

### Roller-Bearing Handbook

HYATT BEARINGS DIVISION, GENERAL MOTORS CORPORATION, Harrison, N. J. Engineering Handbook prepared to aid engineers and designers in determining the loads occurring on roller bearings employed in industrial and automotive applications. Much fundamental engineering data is included. Copies are available to those applying on a company letter-head and stating their position. ..... 1

### Optical Comparators

JONES & LAMSON MACHINE CO., Springfield, Vt. Booklet entitled "Beyond a Shadow of a Doubt," outlining the advantages and possibilities of inspection and measurement by optical projection. Many interesting examples of parts and products inspected with Jones & Lamson optical comparators are shown. ..... 2

### Engineer's Translucent Glass

INDUSTRIAL ENGINEERS SPECIALTIES DIVISION, UNIVERSAL ENGRAVING & COLORPLATE CO., INC., 1919 E. 19th St., Cleveland, Ohio, and 588 Monroe St., Buffalo, N. Y. Bulletin entitled "Helping You to Get the Utmost from Your Projection Measuring Equipment." Also, bulletin on radius charts and projector rules. ..... 3

### Cleaning Materials and Methods

OAKITE PRODUCTS, INC., 26 Thames St., New York City. Publication entitled "A Digest of 54 Essential Maintenance and Related Jobs in Factories and Mills on which Oakite Cleaning Materials and Methods are being Successfully Used." ..... 4

### Handbook for Conomatic Operators

CONE AUTOMATIC MACHINE CO., INC., Windsor, Vt. Handbook containing complete instructions for operators of six-spindle Conomatics. Tables of speeds and feeds for various standard tools and materials, as well as machine time charts, are included. ..... 5

### Precision Machine Tools and Accessories

HARDINGE BROTHERS, INC., Elmira, N. Y. Catalogue entitled "Hardinge Precision Products," covering high-speed lathes, second-operation machines, milling machines, collets, feed-fingers, index fixtures, and circular form and cut-off tools. ..... 6

### Cutting Fluids

TIDE WATER ASSOCIATED OIL CO., 17 Battery Place, New York City. Booklet containing much useful information on cutting fluids. A list of Tycol cutting oils and recommendations for their use on various operations are included. ..... 7

### Gear Finishing by Shaving Process

MICHIGAN TOOL CO., 7171 E. McNichols Road., Detroit, Mich. Manual No. GF-43, containing complete information on gear finishing by the crossed-axis method known as "gear shaving," including types of machines used and applications. ..... 8

### Multiple-Spindle Automatic Screw Machines

C. I. TOGSTAD CO., Machine Tools Division, Kokomo, Ind. Catalogue V-100, illustrating and describing a new twelve-spindle vertical type hydraulically operated automatic bar-feed and chucking screw machine. ..... 9

### Cutter-Grinder Practice

INGERSOLL MILLING MACHINE CO., Rockford, Ill. Bulletin 54, containing information on good cutter-grinding practice, of value to operators and supervisors. The Ingersoll 30-inch cutter grinder is also illustrated and described. ..... 10

### Carbide Tools

MCKENNA METALS CO., 147 Lloyd Ave., Latrobe, Pa. Catalogue 43B, containing 40 pages on standard and special tools, with diagrams showing clearance and rake angles, sizes of Kennametal tips, and directions for use of these tools. ..... 11

### Power Transmission and Materials-Handling Equipment

LINK-BELT CO., 307 N. Michigan Ave., Chicago, Ill. General catalogue 850, covering the company's standard products, including power transmission and materials-handling equipment. ..... 12

### Grinding and Facing Equipment

MUMMERT-DIXON CO., Hanover, Pa. Condensed catalogue 4243, briefly describing Mummert-Dixon suspended swing-frame grinders; radial grinders; facing and boring heads; tool grinders; and wire weaving looms. ..... 13

### Milling Machines

PLAN-O-MILL CORPORATION, Hazel Park, Mich. Catalogue describing the No. 3 Plan-O-Mill for cylindrical parts up to 8 inches in diameter. Catalogue describing the No. 5 Plan-O-Mill for larger parts. ..... 14

### Operating and Maintenance Data for Cecostamps

CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa. Bulletin 276M, containing complete instructions on the installation, operation, and maintenance of Chambersburg Cecostamps. ..... 15

### Air-Conditioning Equipment

GENERAL ELECTRIC CO., AIR CONDITIONING AND COMMERCIAL REFRIGERATION DIVISIONS, Bloomfield, N. J. Booklet describing the new line of G. E. evaporative condensers and evaporative coolers. ..... 16

### Hypro Planers

CINCINNATI PLANER CO., Cincinnati, Ohio. Bulletin 153, covering the Cincinnati Hypro line of double-housing and open-side planers, planer type millers, and vertical boring mills. ..... 17

### Hydraulic Honing Machines

BARNES DRILL CO., 814 Chestnut St., Rockford, Ill. Bulletin 121-H, describing the "Barnesdril" honing process and self-oiling, vertical and horizontal, hydraulic honing machines. ..... 18

### Tool Shanks

COOPER - BESSEMER CORPORATION, Mount Vernon, Ohio. Bulletin 53T-2, on Victory tool shanks, which are cast to shape for tipping with carbide and made for users who tip their own cutting tools. ..... 19

### Grinding Wheels

NORTON CO., Worcester, Mass. Circular entitled "Here's a Grinding Wheel That Can Increase Production on Many Jobs," descriptive of Norton open-structure grinding wheels. ..... 20

### Tubing Connectors

GRINNELL CO., INC., Providence, R. I. Catalogue 1-R, on "Superseal" tubing connectors for steel, copper, aluminum, and other tubing handling oil, gas, air, chemicals, and similar materials for aircraft and all other applications. ..... 21

### Ampco Metal

AMPCO METAL, INC., Milwaukee, Wis. Engineering Data Sheet No. 111, announcing an extruded Ampco alloy known as Ampcoloy 45-22, which is applicable to aircraft production. ..... 22

### Spindle Lathe-Stop

SCHULTZ & ANDERSON, 109 Edison Place, Newark, N. J. Leaflet descriptive of the new Carlson spindle lathe-stop, which is claimed to greatly simplify and speed up lathe operation. ..... 23

### Angle- and Radius-Dressing Instrument

J & S TOOL CO., 477 Main St., East Orange, N. J. Folder descriptive of the "Form-Master," a low-cost, precision, angle- and radius-dresser for abrasive wheels. ..... 24

### Milling Machines

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio. Catalogue M-909-1, containing engineering specifications covering Cincinnati No. 2-24 automatic rise and fall milling machines. ..... 25

### Brazing Alloy for Copper, Brass, and Bronze

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Booklet B-3201, on "Phos-Copper," a brazing alloy for copper, brass, and bronze. ..... 26

### Electric Gages

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin GEA-3991, entitled "21 Electric Gages to Aid Production," covering thickness, magnetic, electrolimit, pressure, strain, and eccentricity gages. ..... 27

### Lathe-Bed Turret

UHLER MFG. CO., 308 North Ave., Mount Clemens, Mich. Circular illustrating and describing the Uhler lathe-bed turret designed to convert small lathes into hand screw machines. ..... 28

### Diamond Dust for Industrial Purposes

J. K. SMIT & SONS, INC., 157 Chambers St., New York City. Folder explaining what to look for in diamond dust for industrial purposes. ..... 29

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### Explosive Rivets for Blind Riveting

E. I. DU PONT DE NEMOURS & Co., INC., Wilmington, Del. Bulletin entitled "How to Use du Pont Explosive Rivets for High-Speed Blind Riveting." ..... 30

### Lathe Maintenance

SOUTH BEND LATHE WORKS, South Bend, Ind. Booklet H-4, entitled "Keep Your Lathe in Trim," devoted to lathe maintenance, lathe tests, and adjustments. ..... 31

### Temperature Recorders

LEEDS & NORTHRUP Co., 4934 Stenton Ave., Philadelphia, Pa. Catalogue N-33-163, containing data on Micromax temperature instruments for the steam plant. ..... 32

### Hardness Testing

NITRALLOY CORPORATION, 230 Park Ave., New York City. Booklet entitled "Hardness," containing a study of the subject of hardness and hardness testing methods. ..... 33

### Refrigerated Welding

FROSTRODE PRODUCTS, 19003 John R St., Detroit, Mich. Bulletin F-43, describing the design and operating features of the "Frostrode" process of refrigerated welding. ..... 34

### Electrode Stub Control

JAMES F. LINCOLN ARC WELDING FOUNDATION, Cleveland, Ohio. Reprint of an article entitled "A Simple Plan for Electrode Stub Control." ..... 35

### Reducer Type Transmissions

REEVES PULLEY Co., Columbus, Ind. Catalogue TR-432, containing complete engineering information on the new Reeves variable-speed transmission provided with built-in reducer. ..... 36

### Colloidal Graphite

ACHESON COLLOIDS CORPORATION, Port Huron, Mich. Circular describing the use of "dag" colloidal graphite for assembling and running-in engines and machinery. ..... 37

### Abrasive-Belt Polishing Backstand

DIVINE BROTHERS Co., Utica, N. Y. Bulletin descriptive of a front controlled unit for converting any lathe to belt polishing and grinding. ..... 38

### Broach Sharpening Machine

COLONIAL BROACH Co., Detroit, Mich. Bulletin CS1-43, on the new Colonial broach sharpening machine for both flat and round broaches. ..... 39

### Photo-Electric Controls

UNITED CINEPHONE CORPORATION, Torrington, Conn. Specification sheet No. 1, containing information on Series 70 photo-electric controls. ..... 40

### Wire Looms with Precrimping Attachment

MUMMERT-DIXON Co., Hanover, Pa. Bulletin illustrating and describing a heavy-duty wire loom with automatic precrimping attachment. ..... 41

### Miniature Precision Bearings

MINIATURE PRECISION BEARINGS, Keene, N. H. Bulletin 43, descriptive of radial and pivot type ball bearings from 1/8 to 5/16 inch outside diameter. ..... 42

### Crane Operation

MANNING, MAXWELL & MOORE, INC., Muskegon, Mich. Folder entitled "Controlling Crane Hooks—a Booklet for New Crane Operators." ..... 43

### Air-Operated Controllers

BRISTOL Co., Waterbury, Conn. Bulletin A112, describing a new line of convertible, free-vane, air-operated controllers. ..... 44

### Scrapers

MURCOTT & CAMPBELL, INC., 582 Union Ave., Brooklyn, N. Y. Bulletin on scrapers for the metal-working industry. ..... 45

### Wood in the War Effort

KAY DISPLAYS, INC., 9 E. 40th St., New York City. Publication entitled "Wood and Its Place in the War Effort." ..... 46

## To Obtain Additional Information on Shop Equipment

**Which of the new or improved equipment described on pages 181-202 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in June, 1943, MACHINERY.**

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# Shop Equipment News

*Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market*

## Eaglesfield Twelve-Spindle Automatic Screw Machine

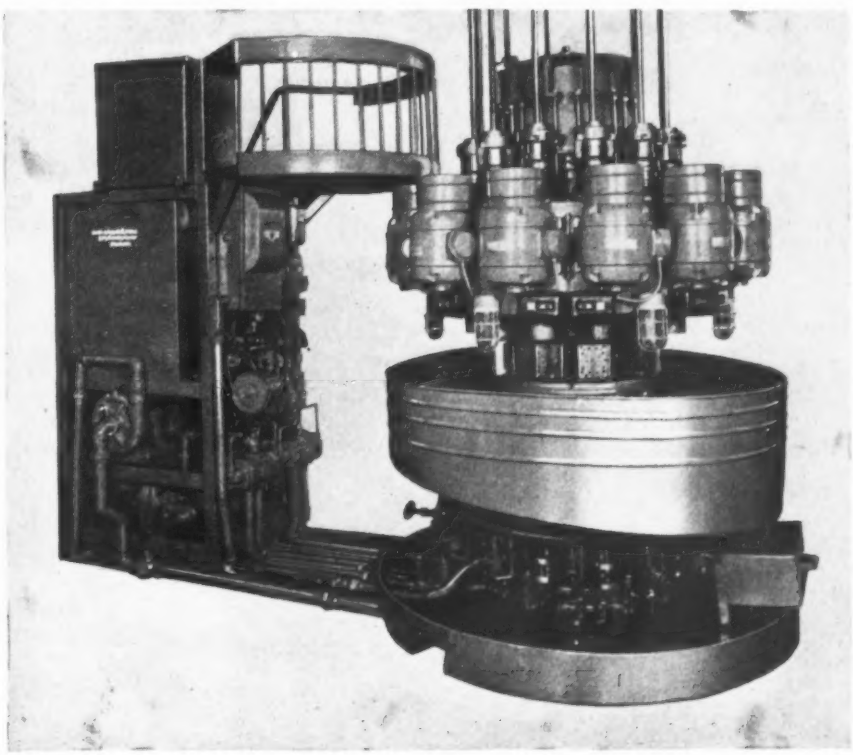
A hydraulically operated, twelve-spindle, vertical type, automatic bar feed and chucking screw machine known as the Eaglesfield "Verti-Matic" is being placed on the market by the Machine Tools Division of the C. I. Togstad Co., Kokomo, Ind. This machine is designed primarily for the fast, accurate production of parts from round, square, or hexagonal bar stock. It can also be used for machining drawn-steel parts of different shapes, and it can be employed, without changes, for chucking operations, the weight of the parts in long magazine tubes serving to automatically discharge the finished pieces. Twelve different operations can be performed on one part, or duplicate tooling can be arranged to produce two, four, six or twelve different parts simultaneously.

The Verti-Matic is composed of two units, the machine proper and the control. The machine proper consists of three main units—the base and column, the lower turret, and the upper turret. The base is a large cast-iron pan with a supporting column extending upward from the center. The column serves not only as a support for the machine, but also as a catch basin for the cutting fluid. The lower turret, which houses the lower spindles with their respective drills, taps, or cutting tools, is fastened rigidly to the column at a height convenient for the operator. This turret also carries the stock locator and the manifold that supplies the cutting fluid. The upper turret is also mounted on the column, but is not fixed radially. Each of the twelve spindles revolves on Timken bearings, and is individually driven by a separate 2-H.P. motor. The drive is by V-belts.

Directly above the lower turret are the twelve horizontal cutting cylinders, with the various tools required. These cylinders are fastened to the column in a radial direction and in line with each spindle. The speed at which the cylinders travel is regulated by means of metering valves. The cutting speed can be accurately adjusted, and a cushioning effect is obtained through the use of the hydraulic feed.

The machine is operated entirely by hydraulic timing which is adjusted by the simple setting of split cams. This timing enables the indexing to be done without shock, and three minor adjustments permit making any desired variation in the operating cycle. The tool feed speed is adjusted by an all-steel valve for each cylinder. A direct-connected pump forces cooling oil to large manifolds.

The maximum collet capacities are 2 inches for round stock, 1 3/4 inches for hexagonal stock, and 1 7/16 inches for square stock. The maximum length capacity with the stock passing through the collet is 12 inches. Any length of bar stock can be placed in the vertical holder, from which it is fed by gravity. The twelve spindle speeds range from 150 to 2500 R.P.M. The 10-H.P. oil-pump supplies 250 gallons of coolant per minute through twenty-four outlets. The machine requires a floor space of 6 by 12 feet, and is 8 feet 6 inches high. ..... 51



Eaglesfield "Verti-Matic" Twelve-spindle Hydraulically Operated Combination Bar-feed and Chucking Automatic Screw Machine

To obtain additional information on equipment described on this page, see lower part of page 180.

## Wickman Swiss Type Automatic

A high-speed Swiss type automatic designed for the manufacture of very small slender parts requiring close limits and fine finish has been brought out by the Wickman Corporation, 15533 Woodrow Wilson Ave., Detroit, Mich. The design of this No. 1 machine is basically the same as that of the No. 2 machine; however, the No. 1 machine has a 5/32-inch bar capacity, with a maximum turning length of 1 9/16 inches, while the No. 2 machine has a 1/2-inch bar capacity.

The new machine is especially suitable for making firing pins; fuse parts; clock, watch, meter, and aircraft-instrument parts; and other slender pieces that it is not practical to make with cross-forming tools. It is stated that small precision parts can be manufactured in one operation on this machine to limits of plus or minus 0.0002 inch as regards both diameter and concentricity. Because of the high degree of accuracy and finish obtained, secondary operations are seldom necessary, and parts having pivot points, back shoulders, multiple diameters, tapers, and bevels can be produced in a single operation.

In this machine, the stock is fed through a guide bushing past radially fed tools. Both the headstock carrying the bar stock and the tools performing the cutting operations are controlled by cams. The machine has a range of spindle speeds from 1500 to 12,000 R.P.M., with cycles varying from two seconds to five minutes. It is designed with the rigidity and spindle speeds required for tungsten-carbide cutting tools. Attachments for drilling, chamfering, counterboring, tapping, threading, and slotting can be furnished. ..... 52

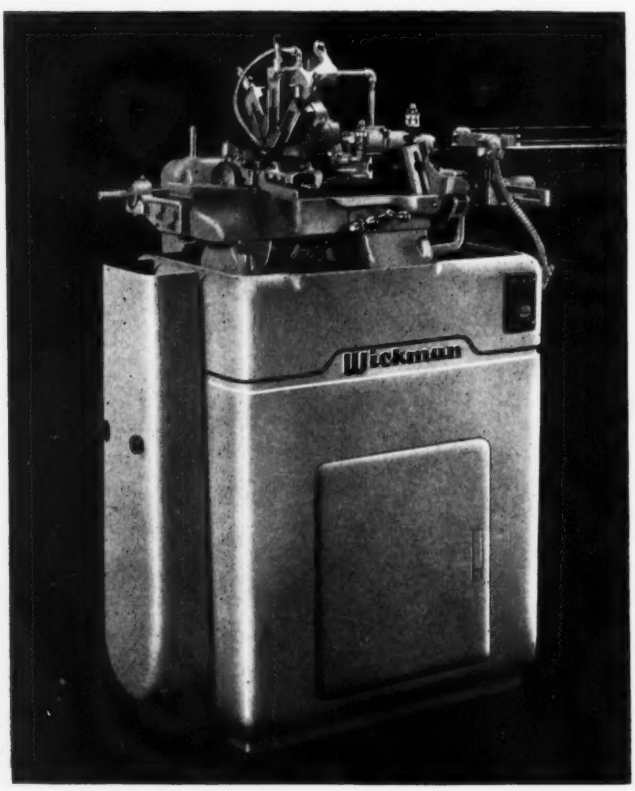
## Rotospray Washing Machine

A washing machine known as the Rotospray, for cleaning such parts as ball bearings, castings, nose sections, cams and gears, impeller shafts, Diesel engine blocks, etc., has been placed on the market by the Industrial Washing Machine Corporation, 290 Burnet St., New Brunswick, N. J. The machine consists of a rotating mesh turntable about 2 feet in diameter, a housing, pump, motor, and spray system.

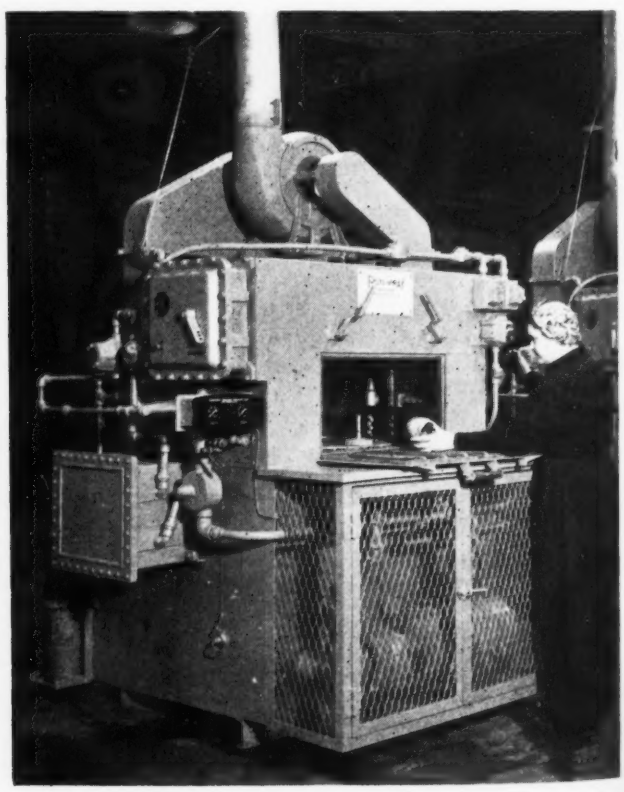
The parts to be cleaned are placed on the turntable, which is rotated by a gear-head motor, and a spray is directed on the work from nozzles at the top, sides, and bottom of the housing. A tilting drain plate, coupled to the fresh water valve handle, prevents the rinse water from draining into the solution tank. Only one inexperienced operator is needed to operate the machine. Any of the cleaning detergents now on the market can be used in it. The machine shown in the accompanying illustration is equipped with explosion-proof switches and a carbon-dioxide fire protection system, as it is used with kerosene. ..... 53

## Marco Permanent Holding Mushroom Inserts

Many attempts have been made to develop means whereby inserts in such materials as plastics, fiber, plywood, copper, bronze, or aluminum can be permanently fixed in place. A new method of this kind has been developed by the Marco Co., Wilmington, Del. It consists, briefly, of a simple means of ex-




Wickman High-speed Swiss Type Automatic



Rotospray Industrial Washing Machine

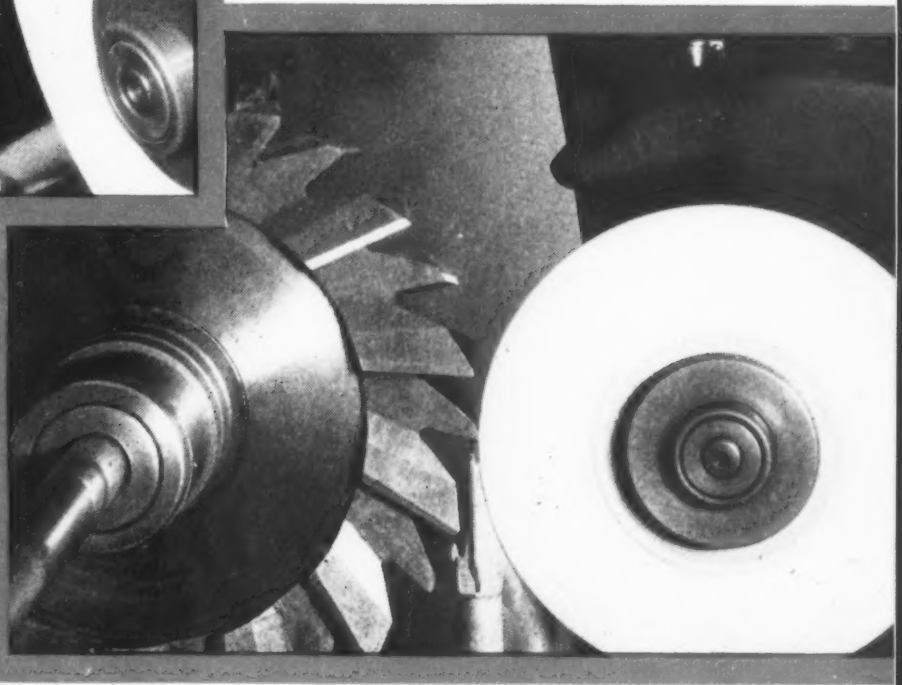


To obtain additional information on equipment described on this page, see lower part of page 180.

# Good Sharpening
## Increases Production
## — and Saves
## High Speed Steel*

In sharpening helical milling cutters, tooth rest should be ground with a slight angle or radius and positioned as shown.

In sharpening staggered tooth milling cutters it is important that tooth rest be pointed and that apex of rest be set in center of grinding edge of wheel.



### *Follow these Simple Suggestions:—*

**1** **CAREFULLY CONTROL CLEARANCE ANGLE** of cutters when sharpening. Incorrect clearance can contribute to chatter and cause premature cutter wear or breakage. Clearance varies with diameter of cutter and material being milled. Soft, tenacious metals frequently require clearances far exceeding those found satisfactory for iron or steel.

**2** **DO NOT FORCE SHARPENING** and burn cutters. Where sharpening is not done carefully the cutting edges can become soft from heating. Keep lands from becoming wide by grinding off heel of land by a secondary operation.

**3** **DO NOT WAIT TOO LONG** (until the cutter becomes very dull) before sharpening. Such a policy can result in losses of high speed steel by excessive metal removed. In production work it is a good plan to sharpen cutters after a certain number of cuts regardless of the cutters' condition.

**4** **SELECT THE PROPER GRINDING WHEEL** which generally should be a soft grade and coarse grain. A hard, fine grain wheel (not recommended) lasts longer but may burn cutter. Keep grinding wheel clean by dressing with an abrasive stick and keep wheel contact with cutter narrow.

**5** **USE SUITABLE EQUIPMENT.** This is important so that the sharpening can be done correctly and economically.

***There is a definite shortage of High Speed Steel. Help conserve this precious metal in every possible way—it is critically needed today for making new cutters.***

We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U.S.A.
BS

*Reproductions of this advertisement for use on your bulletin board furnished on request.*

# BROWN & SHARPE CUTTERS

panding a threaded insert at the bottom by a hand tool which is inserted through a center hole in the insert, the point of the hand tool being shaped to conform to a taper in the insert.

In this way, the insert is forced out or "mushroomed" at the bottom to securely lock it to the part surrounding it. Since the insert is not cut through with slots, either before or after this "mushrooming" operation, there is no possibility of its springing back to its original shape. ..... 54

## Fray Vertical Milling Attachment

A vertical milling attachment applicable to both bench and floor type milling machines is being placed on the market by the Fray Machine Tool Co., Inc., 501 W. Windsor Road, Glendale, Calif. End-mills up to 1/2 inch in diameter can be used for machining tool steel with this Type F attachment. The design is such that tools can be quickly changed.

The 1/2-H.P. Frayco motor furnished with this unit is available for operation at speeds of either 1750 or 3500 R.P.M. The unit has forward, stop, and reverse controls. An adjustable motor bracket permits the motor to swing completely around the head. The spindle speeds for the 1750-R.P.M. motor are 435, 650, 1170, and 3500 R.P.M. For the 3500-R.P.M. motor, the speeds are 870, 1300, 2340, and 7000 R.P.M. Adapters are available in various sizes to fit standard over-arms. ..... 55

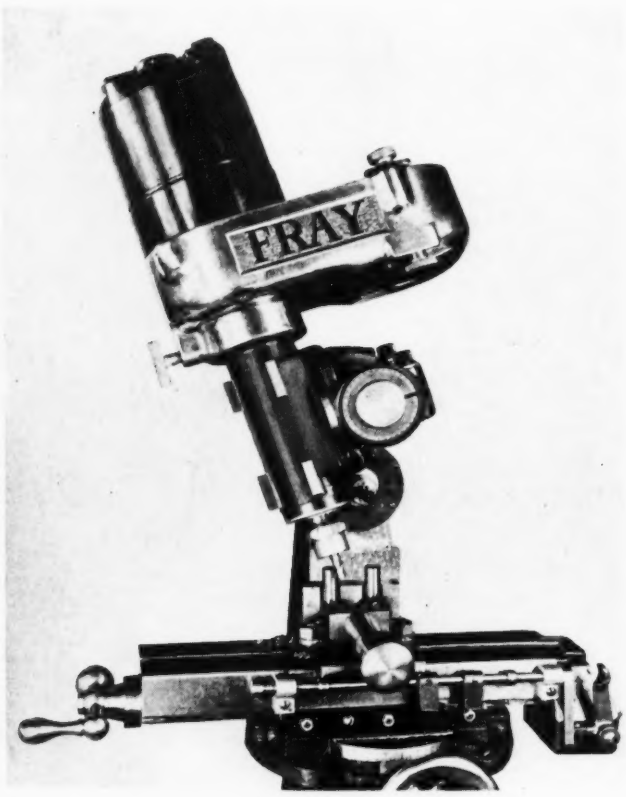
## Bakewell Tapping Machine

A No. 0 bench tapping machine with a lead-screw and electrically operated guide-finger control, designed to insure Class 3 and 4 gage thread fits in small holes, has just been added to the line of the Bakewell Mfg. Co., 2023 Santa Fe Ave., Los Angeles, Calif. This machine contains supersensitive, solenoid-actuated clutches, which can be adjusted by the operator for a torsional resistance to the tap. The down-stroke clutch will release if the tap strikes chips or other obstructions when tapping blind holes close to the bottom. This feature is especially important when small taps are being used.

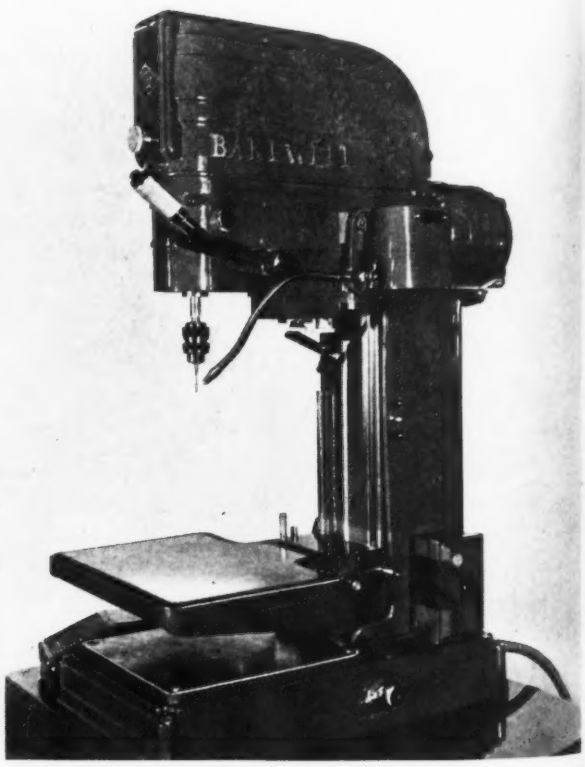
Other features include an accurate limit switch, which controls the depth of tapping to within 0.005 inch; large throat and other working clearances; revolving table indexing adjustment; and spindle speeds ranging from 400 to 1750 R.P.M. The machine has a capacity for tapping from No. 0–80 to 8–32 holes in steel, and up to 10–24 threads in aluminum, magnesium, and other materials softer than steel. It is furnished with or without a cabinet base. ..... 56

## DoAll Lubricant for Metal Sawing

A saw lubricant known as "Saw Eez," compounded to withstand extreme pressures, minimize scoring and heating of the saw, and produce a smoother cut, has just been placed on the market by the DoAll Co., 1215 Thacker St., Des Plaines, Ill. Tests have shown that a 1/2-inch 14-pitch saw used on oil-hardening tool steel developed signs of scoring after cutting 20 square inches of material when no lubricant was used, and became heavily




Fray Vertical Milling Attachment for Use on Bench or Floor Type Milling Machines



Bakewell No. 0 Bench Tapping Machine, with Lead-screw and Electric Finger Control



To obtain additional information on equipment described on this page, see lower part of page 180.

# THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS BRAKES SHEARS

This 3/4" by 14-ft. Shear is typical of the Cincinnati line with capacities of 1 1/4" in thickness, 18-ft. in length, and capable of handling the toughest of materials . . . armor plate. These powerful Cincinnati All-Steel Shears . . . built like a machine tool and equipped with exclusive Cincinnati hydraulic holddowns . . . shear with micrometer accuracy.

*Write for informative book S-3 on the complete line of Cincinnati Shapers.*

scored after cutting 84 square inches; whereas an identical blade used on the same material cut 188 square inches before showing any signs of scoring when lubricated with "Saw Eez."

This saw lubricant can also be used on lathe centers, hacksaws, circular saws, and other bearing surfaces that require intermittent applications of a tough film lubricant. ..... 57

## Vonnegut Plate Grinder

The Vonnegut Moulder Corporation, 1819 Madison Ave., Indianapolis, Ind., has brought out a "GRC" type plate grinder which is available with a 10-inch diameter segmental abrasive chuck driven by a 7 1/2-H.P., 1800-R.P.M. motor or a 14-inch chuck driven by a 10-H.P., 1200-R.P.M. motor. This machine is designed for straight-line grinding, as well as for grinding square and beveled ends and edges of hardened steel plate.

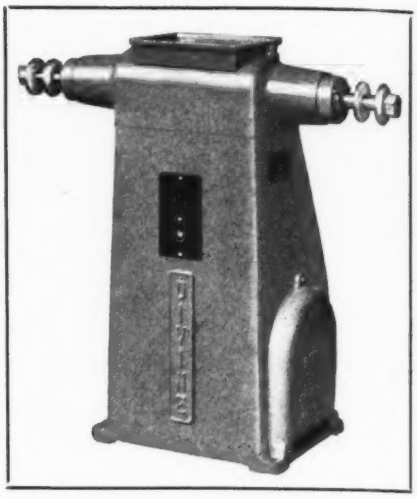
The grinding unit has a 90-degree angular movement, 45 degrees below and 45 degrees above horizontal, with adequate vertical and horizontal adjustment to compensate for angular setting. The angular setting is indicated on a quadrant scale. Angular and vertical positions are secured with positive locking clamps, and end adjustment of the motor unit is maintained through spring pressure friction to permit continuous feeding of the wheel into the work.

The frame of the grinding unit is supported on four grooved wheels which roll on a pair of round steel tracks. The unit is drawn back and forth along the tracks by a power-feed reversing cable drive. The three standard rates of feed are 4, 6 1/2, and 8 feet per minute, but three alternate rates of feed may be obtained. ....58

## Divine Buffing Lathe

A VJ lathe designed especially for finishing, buffing, polishing, and burring small parts has been brought out by Divine Brothers Co., Utica, N. Y., in sizes from 1 to 3 H.P. and with spindle speeds up to 3850 R.P.M. A two-speed drive is available, if desired, as well as stop-start lever brake control of the motor. The bearings are of the "sealed for life" type. An NEMA standard ball-bearing motor is enclosed in the base.

This lathe is of straight-line front design, with ample room between wheels and base, a large tray, spindle lock, and square threads on the spindle. One end of the spindle is tapped to accommodate taper points. ..... 59

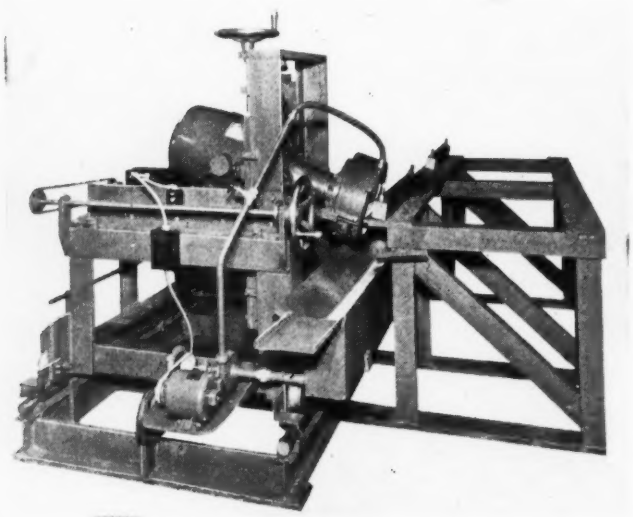


Divine High-speed Buffing and Polishing Lathe for Small Parts

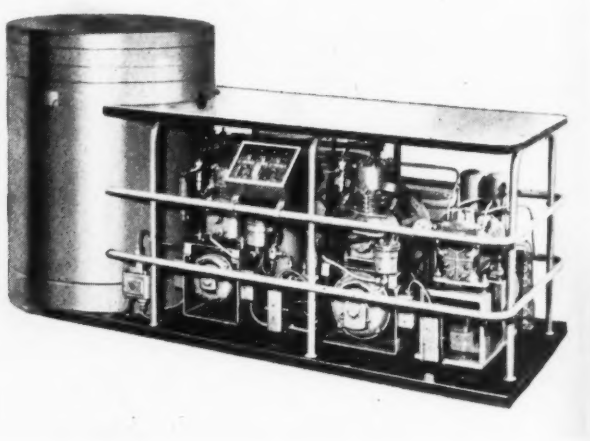
## Deepfreeze "Cascade" Industrial Chilling Machine

An improved style of "Cascade" industrial chilling machine has been placed on the market by the Deepfreeze Division of the Motor Products Corporation, 2301 Davis St., North Chicago, Ill. This machine has been designed for high-production metal chilling of any part where large quantities of heat must be removed rapidly. Employing the "Cascade" principle of two-stage refrigeration, this machine can reach temperatures as low as minus 120 degrees F., and has the capacity at these low temperatures to remove 1000 B.T.U. per hour when work is immersed in the convection fluid. By "Cascade" is meant two-stage refrigeration instead of two-stage compression.

The uses of this machine include the shrinking of metal at minus 100 to minus 120 degrees F. for the assembly of sleeve bearings and ball or roller races otherwise re-



Vonnegut Plate Grinder Suitable for Straight-line and Bevel Grinding

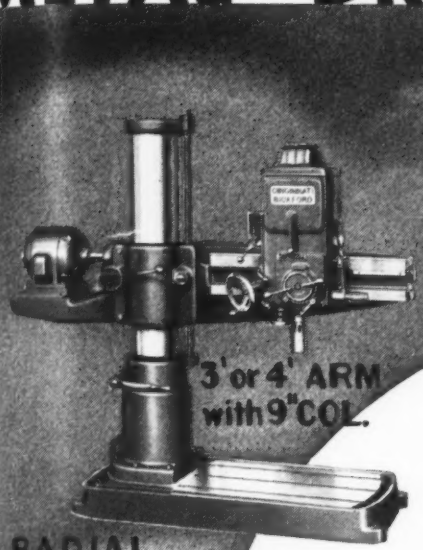


Improved Deepfreeze "Cascade" Type Industrial Chilling Machine



To obtain additional information on equipment described on this page, see lower part of page 180.

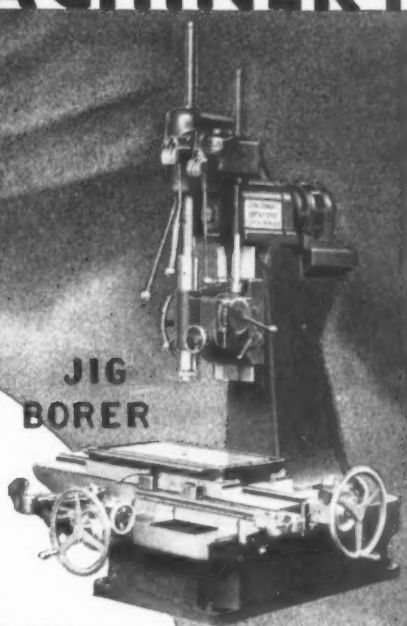
# METAL DRILLING MACHINERY



3' or 4' ARM with 9" COL.

RADIAL
BULLETIN R-21-B

SUPER SERVICE



JIG BORER

BULLETIN U-2

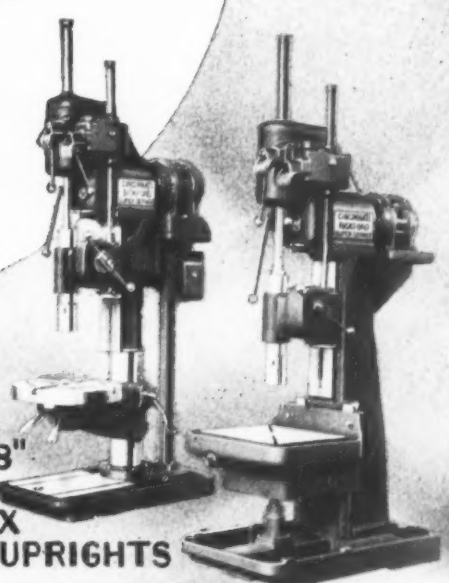
Productivity, Capacity, Adaptability, Reliability, Accuracy, Convenience and Economy are the intangible components that give the Cincinnati Bickford line of drills the appropriate name of SUPER SERVICE.

Examine the possibilities of the machines shown here and for further information send for any or all of the bulletins pertaining to the machines that interest you.

**THE CINCINNATI BICKFORD TOOL CO.**
OAKLEY, CINCINNATI
OHIO

ARMY E NAVY
AWARDED SEPT 10, 1942

4' ARM 13" COL. to
8' ARM 19" COL.
RADIAL
BULLETIN R-24



21", 24", & 28"
ROUND and BOX
COL. UPRIGHTS
BULLETIN U-25

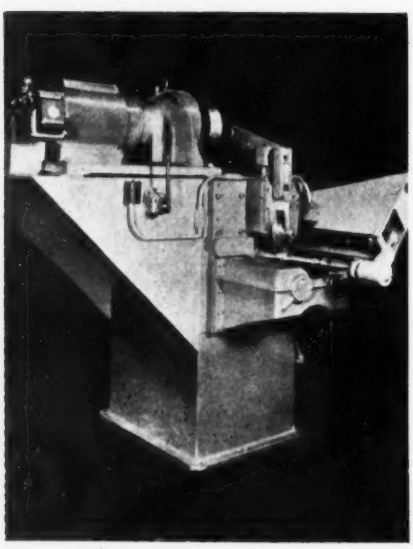
quiring a press fit; the treatment of steel to produce uniform hardness, with all stresses and strains relieved; and the treatment of gages, arbors, etc., to insure dimensional stabilization. ..... 60

## Yoder Shell-Trimming Machine

A shell-trimming machine has been developed by the Yoder Co., Cleveland, Ohio, in collaboration with the Dresser Mfg. Co., Bradford, Pa., maker of shell forgings. This new machine is designed to trim the crop end of the shell forging at the forging plant while it is still hot, thus saving the cost of shipping the scrap or cut-off ends and eliminating the necessity for performing this operation in the machining plant.

The shell is cropped at the forging temperature, the cropping machine being set in the forge production line immediately following the final sizing operation. By a simple adjustment, shell forgings ranging in size from the 60-millimeter trench mortar to the 155-millimeter high-explosive shell can be cropped. A production of 270 cuts per hour can be obtained on the 105-millimeter shell.

The machine is nearly automatic in operation. The hot forging is slid from the conveyor over the mandrel and a starting button pressed. First, an air-operated arm swings into position to hold the shell against the locating mandrel. This mandrel locates the shell from the bottom of the cavity and serves to gage the length of the shell. While the shell is held in this position, the forging is rotated by the two power-driven rolls on which it is supported. The disk type cutter is fed automatically through the forging wall. A roll located on the mandrel prevents the forming of a burr on the inner surface. On completion of the cut, the forging and the cropped end are ejected by actuating an air-operated device, thus completing the cycle. ..... 61



Shell-trimming Machine Developed by the Yoder Co.

## Sturtevant Spring-Testing Device

The P. A. Sturtevant Co., Addison, Ill., has placed on the market a new torque-measuring device for testing compression springs in sizes up to 2 1/2 inches in diameter by 7 inches in length. With this device, the recoil pressure of a spring, when compressed to any predetermined length, can be quickly measured. It also facilitates the selection of an accurately matched set of springs, such as required for engine valves.

The tester is operated with any accurate standard torque wrench, which serves both as the operating lever and the measuring element. A sound device is used to indicate when the spring has been compressed to the test point, thus making it unnecessary for the operator to watch multiple dials. Fine adjustments permit the exact lengths at which the springs are tested to be held to within 0.003 inch. ..... 62

Sturtevant Compression-spring Testing Device

## Noble & Westbrook Cylinder Marking Machine

A high-speed, precision marking machine has recently been placed on the market by the Noble & Westbrook Mfg. Co., Westbrook St., East Hartford, Conn. This machine—the Model 163—is shown in the accompanying illustration equipped for marking identification data permanently into the periphery of aircraft-engine cylinder barrels. Any cylindrical part having a wall thickness that will withstand the marking pressure and within the size range capacity can be handled by this machine.

In marking the pieces, the operator simply places the cylinder barrel or part to be marked on the revolving dial, which rotates continuously and carries the part between the pressure dial and the marking die. The marking is thus impressed into the piece, which continues around to the unloading point. Either solid marking dies or interchangeable steel dies can be used in the die-holder for marking part numbers, inspector's initials, or any other inscription desired. The dial of the machine and the die-holder can both be adjusted vertically to locate the marking at

Machine for Marking Aircraft-engine Cylinder Barrels



To obtain additional information on equipment described on this page, see lower part of page 180.

MANY industries depend upon EX-CELL-O Precision Thread Grinders for production of accurately threaded hardened parts for war work. Outstanding is the aircraft industry. Aircraft engine manufacturers in the United States are using precision thread grinders for threading parts such as cylinder barrels, crankshafts, propeller shafts, crankshaft bearing bolts, connecting rod bolts, tappet adjusting screws, etc. . . . EX-CELL-O precision thread grinders are so dependable that what formerly would have been considered very delicate threading operations on aircraft engine parts are now handled easily, with assured accuracy, high finish, production. . . . EX-CELL-O precision thread grinders grind fine threads directly from heat-treated blanks and finish grind coarser threads after heat treatment.

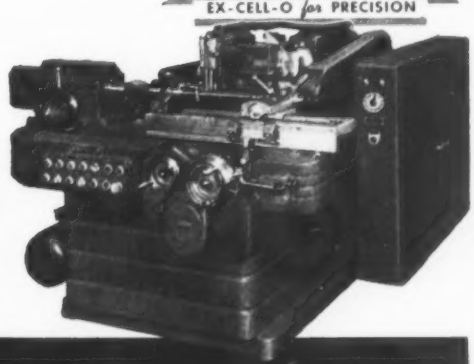
EX-CELL-O CORPORATION • DETROIT

Below: Ex-Cell-O's new catalog on precision machine tools, cutting tools, and other Ex-Cell-O precision products. Contains illustrations, descriptions, and specifications. A copy will be mailed free to any request on business letterhead. Ask for Ex-Cell-O Catalog No. 27121.

"We finish grind these fine pitch threads from hardened solid blanks . . . on EX-CELL-O Thread Grinders!"

XLO

EX-CELL-O for PRECISION



Extreme Accuracy In Form and Lead...*With High Production*

At Right: One of nine styles of Ex-Cell-O Precision Thread Grinders—Style 33 Automatic.

*Precision* THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT PURE-PAK CONTAINER MACHINES • R. R. PINS AND BUSHINGS • PRECISION PARTS

any desired distance from the end of the piece. The carrier dial runs at a slow speed, permitting the work to be easily fed to the dies, while the pressure dial operates at a higher speed.

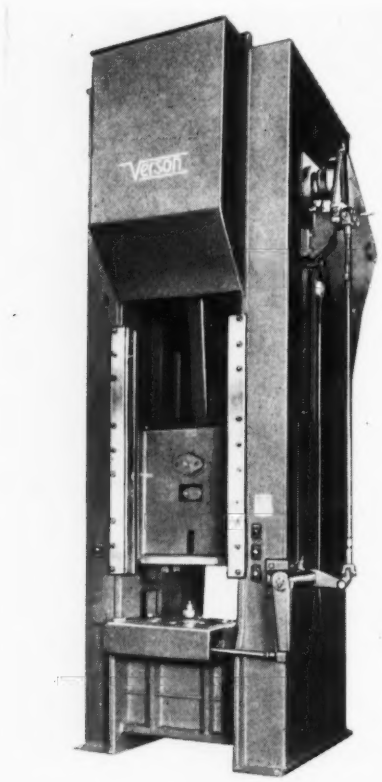
The machine can be furnished for marking parts from 1/4 inch to 8 inches in diameter, and the marking can be placed on the part close to the end or from 3 to 4 inches from the end. ..... 63

## Verson Cartridge-Case Drawing Press

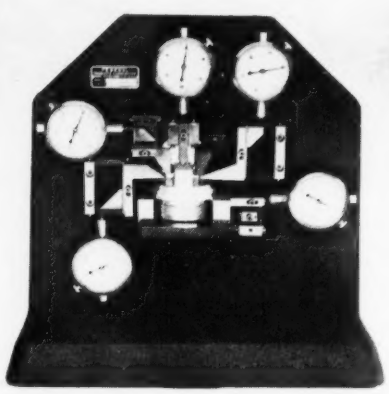
The Verson Allsteel Press Co., Chicago, Ill., has designed and is building an eccentric type cartridge-case drawing press for the production of both brass and steel cases. These presses are built for use in all stages of cartridge-case fabrication, from the preforming to the drawing, heading, tapering, and piercing operations. They are available for making cases of all sizes up to 105 millimeters.

This press, when equipped with a dial feed, can be operated at a speed of 15 productive strokes per minute. The dial feed is interlocked with the press circuit, so that the press cannot be operated unless the dial is properly indexed. The pneumatic clutch and brake unit is controlled electrically by push-buttons.

Increased punch and die life is obtained by using extra long gibs, which securely confine the slide at all positions of the stroke. The front gibs are adjustable, and all gibs are bronze-lined. This cartridge-case drawing press, like all Verson presses built for such service, is of unbreakable, solid steel frame, welded construction. 64




Verson Eccentric Type Cartridge-case Drawing Press



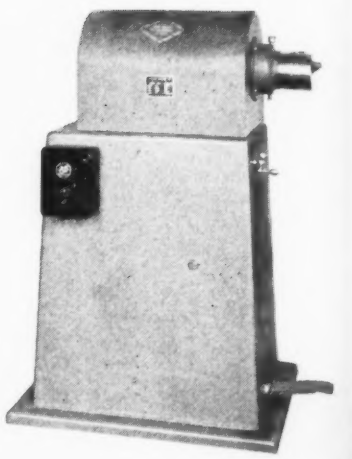
Federal Thickness, Height, and Distance Gage for Fuse Bodies

## Multi-Check Fuse Gage

A thickness, height, and distance gage for checking five separate dimensions on a fuse body in one operation has been placed on the market by the Federal Products Corporation, 1144 Eddy St., Providence, R. I. After the gage is set to a master, the fuse body is positioned accurately in the gage by placing it on three supporting blocks. The five dial indicators are actuated by pantograph units which make contact with the fuse body, so that the sensitive indicator points do not become worn or damaged in use. The indicator graduations are in 0.0005 inch, and the range is 0.075 inch. ..... 65

## Schauer Variable Speed Lathe with Reeves Drive

The Schauer Machine Co., 2062 Reading Road, Cincinnati, Ohio, has brought out what is known as the "Ideal" variable speed lathe,



Schauer Speed Lathe for Lapping and Finishing Metal or Plastic Parts

which is suitable for lapping and finishing metal or plastic parts at speeds as low as 100 R.P.M. and as high as 4800 R.P.M. It has been found especially applicable for the final finishing operations on heavy work that requires burring, filing, polishing, and lapping.

The variable speed is obtained through a Reeves drive. A Twin Disc clutch transmits power from a continuously running motor to the spindle of the speed lathe when a foot-treadle is depressed. When the foot-treadle is released, a disk type brake is automatically applied. The variable speeds are selected by the ball-crank handle on the side of the machine. The variable-speed ratio is 6 to 1 for one-speed motors, and 12 to 1 for two-speed motors.

The spindle and holding devices are contained in a separate welded steel housing mounted on a welded steel floor type pedestal. This construction practically eliminates vibration when handling heavy work at high speeds. The chuck end of the spindle can be provided with a taper hole or a removable taper socket. ..... 66

## Chatillon Tension and Pressure Gages

A simple push-pull gage for measuring tension, pressure, mechanical reaction, and breaking strains in the laboratory or shop has been developed by John Chatillon & Sons, 85 Cliff St., New York City. Forces from the most minute up to 100 pounds can be measured

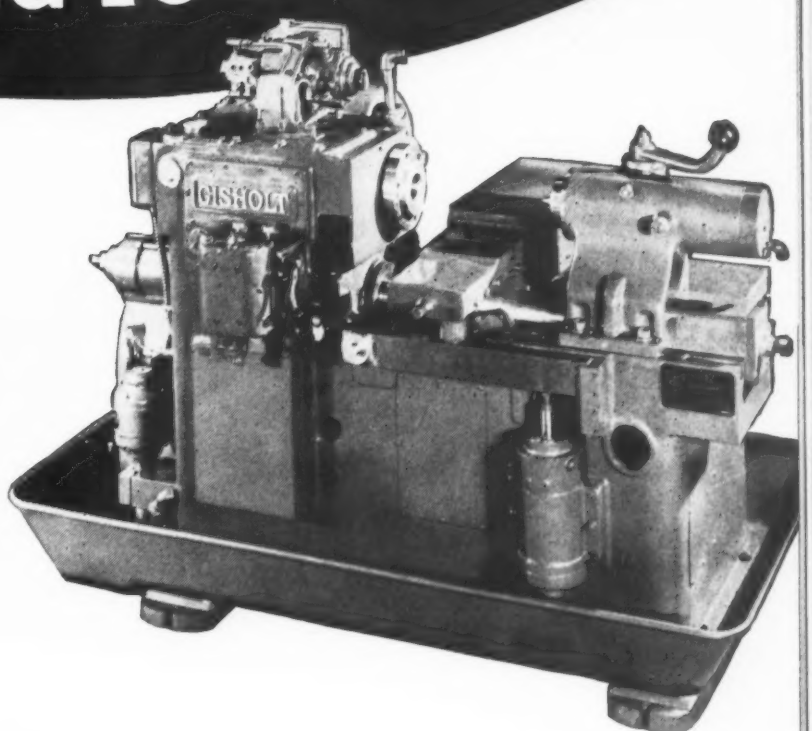


To obtain additional information on equipment described on this page, see lower part of page 180.

# HOW LONG TO LEARN THIS?

WITH this one simple control, the operator of a Gisholt Hydraulic Automatic Lathe performs an entire cycle of machining operations. The machine does all the rest—swiftly, accurately—and so completely that one operator can tend two or even three machines.

The fact that very little training is required makes the Gisholt Hydraulic Automatic Lathe an especially valuable wartime tool wherever parts are machined in large volumes.




**GISHOLT MACHINE COMPANY**
1209 E. Washington Avenue • Madison, Wisconsin

**THE GISHOLT HYDRAULIC AUTOMATIC LATHE**
—rigidly built for multiple cutting with accuracy at high cutting speeds, handles a wide variety of chucking and between-centers work. Literature on request.

*OOK AHEAD . . . . KEEP AHEAD . . . . WITH* GISHOLT *IMPROVEMENTS IN METAL TURNING*

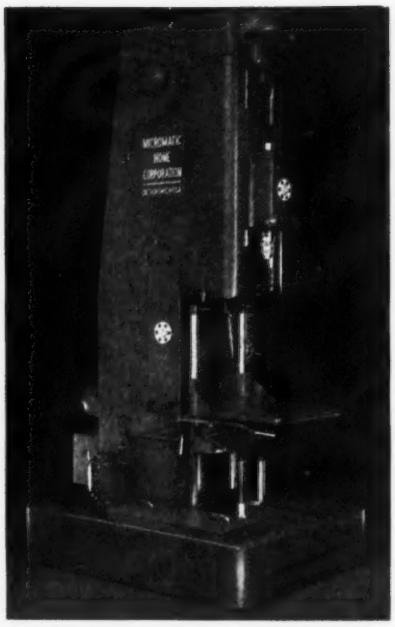
*The Army-Navy "E" and the Treasury Flag fly side by side at Gisholt.*

TURRET LATHES · AUTOMATIC LATHES · BALANCING MACHINES

by these gages. Among their applications may be mentioned the testing of spring characteristics, the measuring of the pull of a relay or magneto, the checking of pressures required to operate push-button switches, the adjusting of spring-loaded mechanisms, and the determining of the tensional strength of materials within the capacity of the gage. Each gage is individually calibrated. ..... 67

## Delta Chip-Breaker Grinder

A machine for grinding the chip-breaker groove in carbide-tipped tools has been brought out by the Delta Mfg. Co., 606-F E. Vienna Ave., Milwaukee, Wis. This machine is also applicable to the grinding of accurate form tools, thread chasers, and other cutting tools. A universal vise with four distinct planes of adjustment and a separate scale for each facilitates resetting work to the exact original angle. The grinder will handle a work-piece of 13 1/2 inches maximum length, 6 inches maximum width, and provides a maximum clearance from wheel to table of 7 inches. Cup-wheels up to 7 inches in diameter are used. ..... 68



Micromatic Honing Machine

## Micromatic Vertical Honing Machine

A new line of vertical honing machines has been placed on the market by the Micromatic Hone Corporation, 8100 Schoolcraft Ave., Detroit, Mich. These machines are made in two models, the first having a capacity for handling work from 1/4 to 7/8 inch in diameter and up to 12 inches long, and the second work from 7/8 inch to 2 inches in diameter and up to 12 inches long. Both models have a maximum working stroke of 15 inches.

Standard manual adjustment is provided for the spindle head, and there is also an adjustment of the lift-out stroke above the operating stroke. Additional controls provided in the hydraulic control panel include automatic timer for cycle of spindle head movement; manual visual control of tool approach to work; dwell control for spindle head stroke; and emergency stop for spindle head movement. Electric push-buttons control starting, stopping, and short-stroking. The machines are regularly furnished with riser-block tables and have ventilated columns. ..... 69

## Sigourney Sensitive Drilling Machines

Two new model sensitive drilling machines, known as M-100 and M-100A, have been brought out by the Sigourney Tool Co., Hartford, Conn. The Pratt & Whitney Division of Niles-Bement-Pond Co., West Hartford, Conn., is sole sales

Delta Chip-breaker Grinder with Universal Vise

Sigourney Sensitive Drilling Machine



To obtain additional information on equipment described on this page, see lower part of page 180.

# RHYTHM CAN BE DESTRUCTIVE

THE rhythm of marching feet can set in motion forces that will make a great bridge tremble and sway.

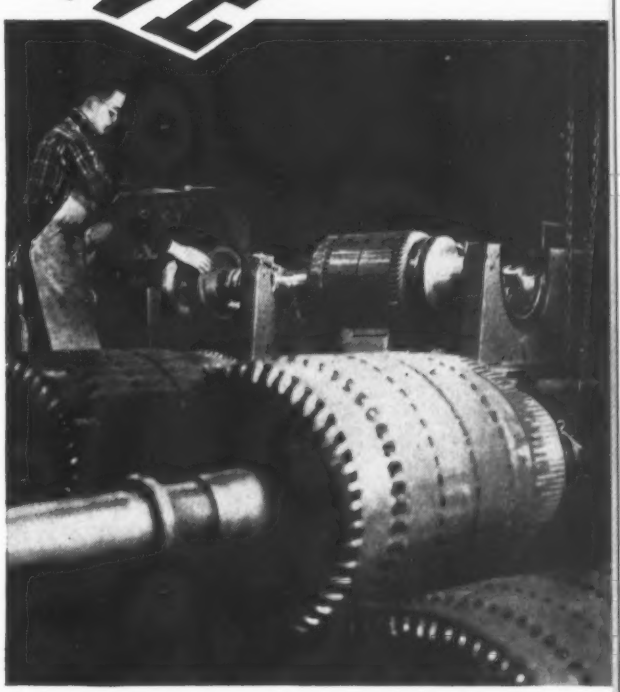
These forces of rhythmic vibration are at their destructive worst when found in high-speed rotating parts. They attack entire assemblies, causing excessive wear, bearing overloads, loosening of parts, and early failure.

Today, Dynetric Balancing Machines work wonders in assuring quiet, efficient operation, and longer life. They determine static and dynamic balance more quickly, more economically, and more accurately than ever before.

**GISHOLT MACHINE COMPANY**
1209 East Washington Avenue • Madison, Wisconsin

*Look Ahead—Keep Ahead—*
*With Gisholt Improvements*

GISHOLT



**DYNETRIC BALANCING MACHINES**
*locate and measure unbalance in a few seconds. By means of electron tube amplification, accurate readings down to .000025" are possible. Write for literature.*

**TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES**

agent for these machines. The advantages of the new models are greater sturdiness, higher spindle speeds, and safer operation due to complete enclosure of all moving parts, except the chuck and drill itself.

Precision sealed ball bearings insure smooth operation at 4000, 7000, and 10,000 R.P.M. A special motor is used if speeds of 2000, 3500, and 5000 R.P.M. are desirable. Space blocks can be inserted between the column and base to increase the distance from the table top to the chuck. The table and column are accurately squared with each other. The Model M-100 drilling machine has a horizontal distance from face of column to center of chuck of 4 1/2 inches, while the Model M-100A provides 7 inches clearance. Both models are available with one, two, three, or four spindles. 70

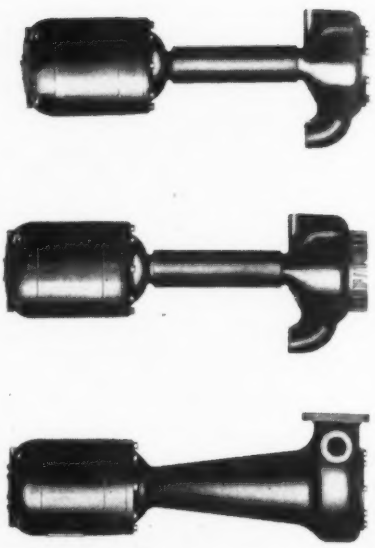
## Yoder Roll-Grinding Machine

The Yoder Co., Cleveland, Ohio, has developed a new machine for grinding the rolls used in roll-forming machines. This grinding machine has a maximum length of 20 inches between centers and a 16-inch diameter capacity. A two-speed table feed and a nine-speed work-head drive are provided. The speed variations are obtained without belt or gear change. A precision-built high-speed spindle, dust protection, and centralized controls are among the features of this machine. 71

## Pioneer Coolant Pumps

Three new coolant pumps, each available in seventeen standard sizes, which are referred to as war models, have been brought out by the Pioneer Pump & Mfg. Co., 19643 John R St., Detroit, Mich. These pumps have been designed especially to conserve important materials, and are constructed to assure a constant flow of coolant, thus reducing the possibility of pump failure

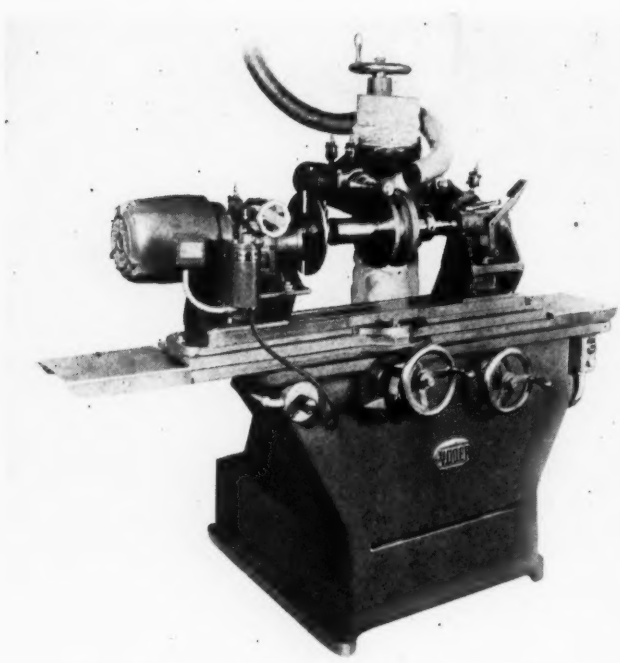
The versatility of application, making these pumps interchangeable with other makes, enables the user to keep his inventory at a minimum, since each pump can be applied in many different ways. The Model VBD pump has three outlets to permit piping on either the right or left side or back into the coolant sump through the intake bracket. The Model VA pump is used where submersion in the coolant sump is more practicable or less objectionable than outside mounting would be. The Model VC pump is designed for external use in cases where a tank cannot be utilized efficiently. 72



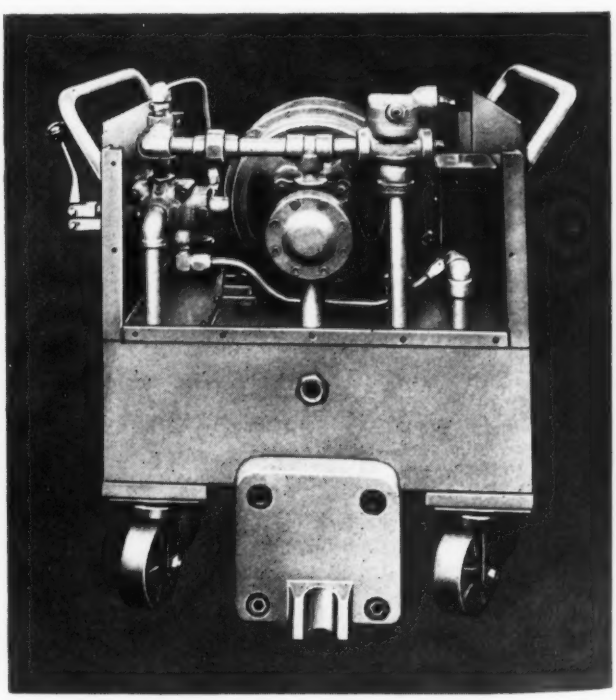
Pioneer Coolant Pumps Available in Seventeen Sizes

## Watson-Stillman Portable Ship-Frame Bender

A completely enclosed, self-contained, portable ship-frame bender having a maximum capacity of 18 tons is being manufactured by the Watson-Stillman Co., Roselle, N. J. The outstanding feature of this machine is the overhead swivel electrical connection to the power



Roll-grinding Machine Built by the Yoder Co.



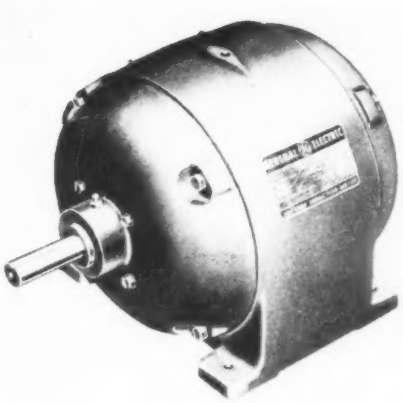
Watson-Stillman Portable Ship-frame Bender



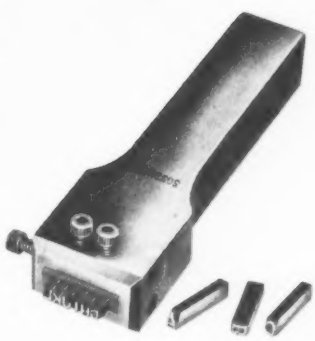
To obtain additional information on equipment described on this page, see lower part of page 180.

source, which eliminates the hose ordinarily employed to make connections with a central accumulator. The machine, mounted on wide swivel casters, can easily be moved about the ship's deck or the ways.

The completely enclosed 3-H.P. motor of either alternating- or direct-current type provides pumping capacities of 41 and 5 gallons per minute, respectively, using oil as the hydraulic medium. The entire unit is 2 feet 7 inches wide by 2 feet 7 inches high. The machine weighs 1100 pounds. .....73



G-E Totally Enclosed Motor



Sossner Numbering Device

## General Electric Totally Enclosed Motors

A new line of totally enclosed motors especially designed for use where abrasives, chemicals, rain, snow, and excessive dirt are encountered has been developed by the Motor Division of the General Electric Co., Schenectady, N. Y. These motors are available in both the polyphase, 60-cycle, induction type, and the single-phase, 60-cycle, capacitor type. They have all the important basic features of the Tri-Clad group, including protection against physical damage, electrical breakdown, and normal operating wear and tear. The leads are permanently encased in a compound to prevent liquids from seeping into the motor, and a rotating labyrinth seal prevents dirt, oil, or water from entering the bearing housing. .....74

## "Time-Saver" Numbering Device

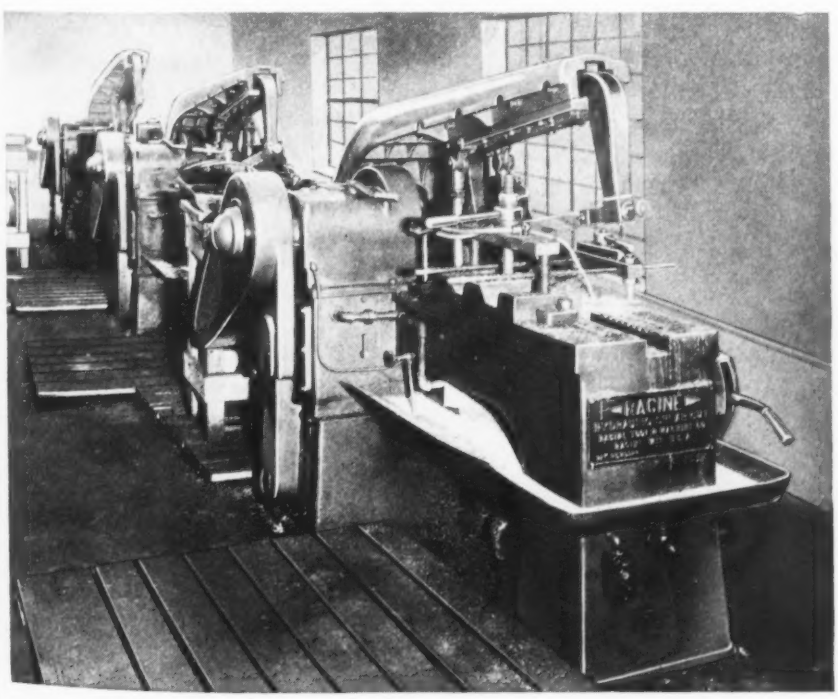
An improved "Time-saver" device for parts numbering has been placed on the market by Sossner, 161 Grand St., New York City. The tool-steel holder is designed to accommodate up to eight pieces of type, and these are held in place by screws instead of springs. Holders for twelve pieces in one, two, or more lines can be obtained if specified. The device is available for hand and press use. The type is made of tool steel, individually hand engraved and hardened. .....75

## Special Racine Metal Saws for Armament Work

The standard line of metal-cutting saws made by the Racine Tool & Machine Co., Racine, Wis., has been converted for war production work, including such operations as shell cutting, rifle-barrel cutting, the cutting of torpedo flasks, bomb-ends, cannon and gun-barrel forgings, etc. All saws are hydraulically fed and controlled. The flexibility of these saws permits quick and easy application of many different types of jigs and fixtures designed for accurate and fast production on unusual metal-cutting operations.

With simple single-lever control, these Racine "oil-cushioned" saws have a complete range of feeds for cutting the full run of metals from thin-walled tubing, aluminum, and soft steels through hard steels, special alloy and stainless steels, die-block steels, etc.

Accurately controlled dual feeds are provided to assure long blade life, increased cutting speed, and greater cutting accuracy. The complete line ranges in capacity from 6 by 6 up to 20 by 20 inches. .....76




Racine Heavy-duty Metal Saw Equipped for Trimming Forging Flash from Shells

## Basket for Cleaning Small Parts

For use in cleaning small parts, the Curran Corporation, Malden, Mass., has patented a "dunking" and dryer basket designed to fit the standard 5-gallon steel pail contain-

To obtain additional information on equipment described on this page, see lower part of page 180.

# CARBIDE TOOL

## ★ CARBIDE TOOL TRAINING COURSE

To help carbide users in war industries speed the training of new men, appren-tices, and those being converted to carbide tool use in the metal working trades, Carboloy Company operates an instruction course at its Detroit plant for the training of carbide users' key men. These men receive one week's training in the fundamentals of design, brazing, application and maintenance of carbide tools through actual shop practice, discussion periods, and training film showings. The men return to their own plants with a basic knowledge of carbide practice and recommended procedure for training their own men, assisted, when desired, by our field engineers.

During the two years in which this training course has operated, carbide users in 39 states and 3 allied countries have received this training. The course is operated without charge as a service to war industries. A similar service is available to cartridge case die users—to instruct in the finishing and servicing of carbide dies for drawing cartridge cases.

## ★ FIELD SERVICE

Since the day cemented carbide was first introduced—as a new, strange, "revolutionary" tool material—Carboloy has maintained a large, active staff of experienced field engineers to assist users in all phases of carbide tool practice. As an example of the type of service these men render, in one year alone they trained more than 5,000 men in users' plants in the correct methods of rapid carbide tool grinding.

## ★ RESEARCH AND DEVELOPMENT

A special committee on research and development functions at Carboloy to constantly improve present methods and develop new methods, new materials for the future. The work of the men on this committee, headed by Dr. Zay Jeffries, metallurgist and Chairman of the Board of Directors of Carboloy Company—has resulted in many outstanding contributions now helping to further speed war production through carbide usage. This committee will continue its efforts to advance the art in the days of peace as well.

# To Help You Further Increase War Production

## ★ TRAINING FILMS

To help in the gigantic task placed upon industry and government, of training new thousands of workers, a set of six carbide training films—as described below—was made available by Carboloy to industry last fall—to provide detailed training in all phases of carbide tool use. (Booklet GT-151.)

**Film—"WHAT IS CEMENTED CARBIDE?"** Designed to provide a knowledge of what cemented carbide is, physical characteristics, and how made. Valuable for understanding subsequent recommendations.

**Film—"DESIGNING CARBOLOY TOOLS"** Reviews for tool designers, the requirements necessary in designing tools with carbide tips. Covers tool styles, tip and shank sizes, rakes, etc., for single point tools.

**Film—"BRAZING CARBOLOY TOOLS"** Procedure for torch brazing carbide blanks to steel shanks, including single and multiple point tools, renewing worn out H.S.S. cutters with carbide tips, etc.

**Film—"CHIP BREAKERS"** Shows how to determine most efficient chip breakers for carbide steel cutting tools; how to adjust to meet individual conditions; and step-by-step grinding procedure.

**Film—"GRINDING CARBOLOY TOOLS"** Step-by-step grinding procedure for single point carbide tools from brazed, damaged and ordinary dulled states. How to rough rapidly and finish accurately.

**Film—"PUTTING CARBOLOY TOOLS TO WORK"** Important for the operator applying carbide tools. In three parts: Part I—Putting tool on machine. Part II—The machine. Part III—Trouble shooting.

## ★ SPECIALLY DEVELOPED CARBIDE TOOL GRINDING EQUIPMENT

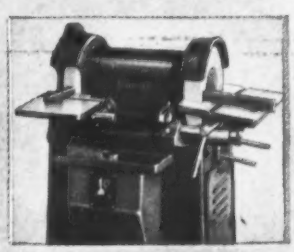
Important factor in obtaining maximum economy and top production with carbide tools is proper grinding. To provide the most efficient grinding equipment for this vital work, Carboloy Company—in cooperation with machine tool builders—developed special grinders for carbide tools. This equipment—together with the now well established rapid grinding technique—is conserving carbides and reducing down time on thousands of war jobs.

The 14" carbide grinder for use with vitrified cup wheels. For all sizes of Carboloy tools. Accommodates two operators. (Above.)

*New!*—Improved type of grinder for grinding chip breakers in carbide steel cutting tools, including roller turner tools. Sturdier, larger table, high and low speed table travel. Also adaptable to grinding precision boring tools and flat form tools. (Right.)

The 6" carbide grinder for use with diamond wheels and lapping discs, as well as vitrified cup wheels. (Bottom right.)

10-inch Carboloy Grinder for peripheral and face grinding on vitrified straight and cup wheels. (At bottom.)



## ★ Comprehensive Educational Literature on All Phases of Carbide Tool Use

Each year Carboloy publishes comprehensive engineering bulletins covering latest carbide practice. Current booklets include D-113-R—finishing and servicing cartridge case dies—GT-133—carbide tool manual of design, brazing, grinding, application—GT-127—grinding carbide end cutting tools.

## ★ Engineering Articles in the Technical Press

Through frequent articles in technical magazines Carboloy engineers disseminate information on current phases of carbide use important to war industries. Milling with carbides, machining cast armor plate, renewing worn high speed steel tools, are a few of the many subjects covered in the past 12 months.

**CARBOLOY COMPANY, INC., 11147 E. 8 MILE AVE., DETROIT, MICHIGAN**

*Sole makers of the Carboloy brand of cemented carbides*

Birmingham, Ala. • Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh • Seattle

*Canadian Distributor:* Canadian General Electric Co., Ltd., Toronto, Canada

# CARBOLOY

TRADEMARK

## CEMENTED CARBIDES

TRADEMARK

ing the company's Carbon Met substitute for carbon tetrachloride.

In use, it is only necessary to place the part to be cleaned in the basket and immerse it in the volatile Carbon Met contained in the pail. After immersion, the basket can be attached to the edge of the container by clips on the handle to permit the excess solvent to drain back into the pail. ....77

## Universal High-Speed Milling Machine Attachment

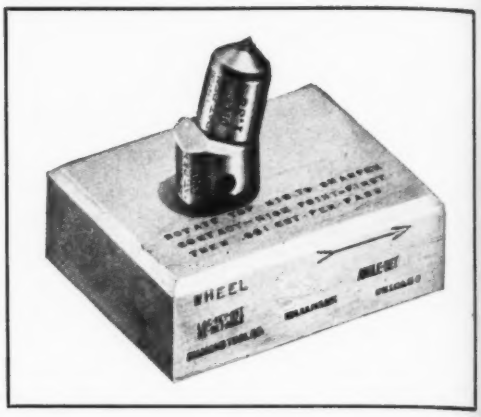
A universal milling machine attachment that can be applied to most makes of over-arm type milling machines in the manner shown in the accompanying phantom view is being made by Leo G. Brown Engineering Co., 216 S. Vermont Ave., Los Angeles, Calif. The sleeve of the attachment is available in 2-, 2 1/8- and 2 1/4-inch diameters to fit the over-arm bores of different milling machines. Sleeves of special sizes, however, can be made to order to suit requirements.

The universal head is power-driven by a belt from a pulley mounted on the rear end of the milling machine spindle. The belt drives the cone pulley at the rear end of the attachment sleeve. The compound spiral and bevel gears of the head, which run in an oil-filled housing, step up the spindle speed of the attachment in the ratio of 2 to 1. This arrangement provides spindle speeds up to 3000 R.P.M. The collet draw-bar has a 1/2-inch bore to permit the tool shank to extend through the spindle of the milling head when necessary. The head is equipped throughout with ball bearings. ....78

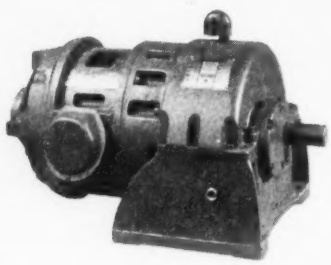
## Diamond "Angle-Set" Magnet Block

What is known as an "Angle-Set" magnet block has been brought out by the Diamond Tool Co., 938 E. 41st St., Chicago, Ill., for dressing wheels on grinding machines equipped with magnetic chucks. This is a development of the company's Angle-Set tool to adapt it for accurate diamond dressing of surface grinders. The dresser is designed for wheels up to 8 inches in diameter, but for larger sized wheels larger diamonds can be set in it. It is stated that a diamond can be kept sharp by rotating only the top nib.

The dresser comprises three units —the magnet block, 2 1/2 by 3 by 1 inch, a 12-degree Angle-Set, and a nib containing the diamond. ....79




Dresser for Surface Grinder Wheel Made by Diamond Tool Co.



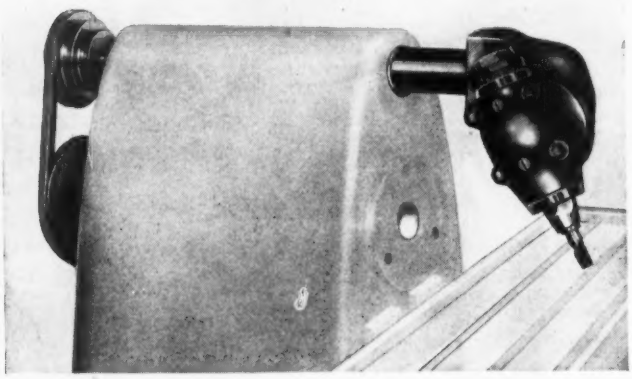
Westinghouse Gearmotor of New Horizontal Type Line

## Westinghouse Gearmotors

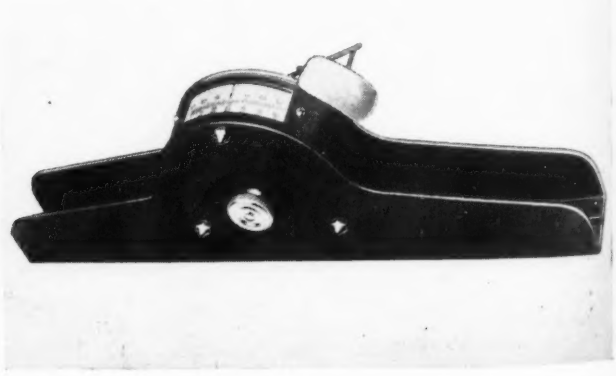
A new line of horizontal, parallel-shaft type gearmotors that meet speed reduction requirements over a range of 1 to 75 H.P. has been announced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Adapters between motor and mechanical parts allow the use of any standard Westinghouse NEMA frame motor with each type of unit, so that motors can be readily changed in the field. Gears and pinions in these new gearmotors are of 0.40 to 0.50 carbon steel, and are given special heat-treatment before hobbing. This process produces a tapering hardness from surface to core and results in tough impact-resisting teeth. Gears and bearings are lubricated by a positive splash system, and a new case design allows oil to circulate freely. ....80

## Vernier Angle Gage

A vernier angle gage designed for a wide variety of uses has recently been placed on the market by the Engis Equipment Co., 310 S. Michigan Ave., Chicago, Ill. The "Clinometer," as this instrument



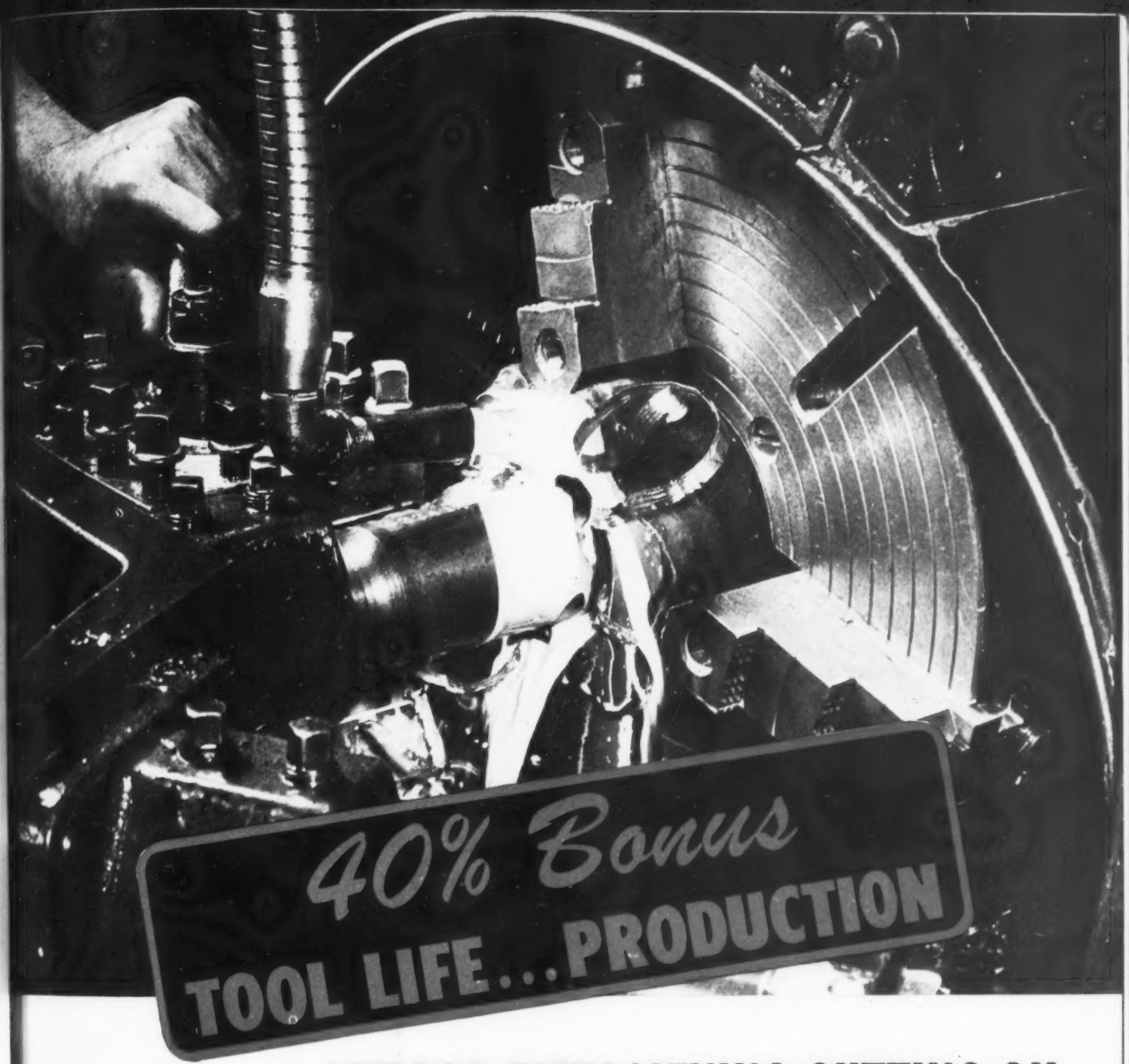
Milling Machine Attachment Made by the Leo G. Brown Engineering Co.



"Clinometer" Vernier Angle Gage Placed on the Market by Engis Equipment Co.



To obtain additional information on equipment described on this page, see lower part of page 180.




# SUNOCO EMULSIFYING CUTTING OIL

## prolongs tool life... improves finish... increases production

The longer cutting tools last on the production lines ... the more vitally needed war material can be produced for the fighting line.

The value of the right cutting oil in prolonging tool life was amply proved by a large manufacturer of war material. When using a competitive cutting oil production was seriously slowed down because of short tool life . . . poor finish . . . and bad operating conditions. Then he switched to Sunoco Emulsifying Cutting Oil on his Warner & Swasey turret lathes. The high heat absorbing lubricating qualities of Sunoco stopped the trouble. Results . . . tool life and production stepped up 40% . . . finish on parts greatly improved.

From metal working plants large and small on America's production front reports such as these are constantly being received. Facts that prove why the majority of metal working plants flood their tools and work with Sunoco to get more pieces between tool grinds, reduce rejects, and make every man-hour and machine-hour result in peak production. Call in a Sun Doctor of Industry, let him prove the production value of switching to Sunoco in your own plant. Write

**SUN OIL COMPANY, *Philadelphia***

*Sun Oil Company, Limited, Toronto, Canada*

**SUN INDUSTRIAL PRODUCTS**

SUNOCO

***HELPING INDUSTRY HELP AMERICA***

is called, is recommended for general use wherever angles and inclines must be laid out or checked. It is adapted for use on various types of machine tools, such as lathes, drill presses, shapers, gear-hobbing machines, etc., and for testing set-ups in the inspection room. Special models are furnished for the testing of airplane propeller blades, ships' propellers, and templets. It is available in five regular models.

Minutes of the arc are indicated by a separate vernier scale. Reading is facilitated by a patented brake mechanism and by an attached magnifying glass. The rotating drum can be locked in position by a hand-knob, so that readings can be taken after the instrument has been removed from the surface being tested. .....81

## Improved Case for DoAll Gage-Blocks

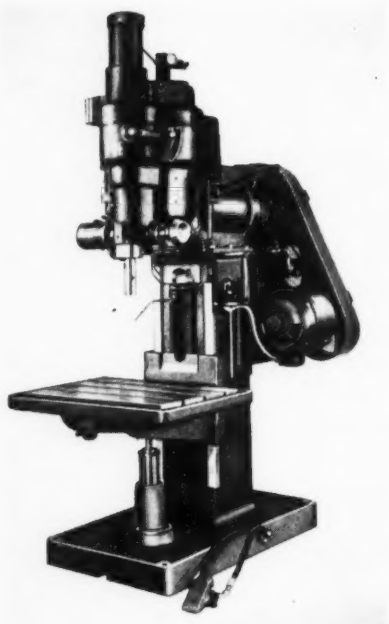
The Savage Tool Co., 123 Fourteenth Ave. S., Minneapolis, Minn., announces an improved case for the DoAll precision gage-blocks described in February MACHINERY. Heretofore, the gage-blocks have been kept in a large case in which the blocks were placed flat in recesses. This necessitated a large, cumbersome box, particularly for the standard set of eighty-one blocks. The new case designed for these gage-blocks is only one-fourth as large as the previous one, yet it holds the precision gages in full view of the user.

The box is constructed of kiln-dried solid walnut, properly treated to insure against acidity of the wood affecting the highly polished surfaces of the gage-blocks. The case is 11 by 4 1/2 by 2 inches, and can be stored in the drawer of a machinist's tool-box. .....82

Improved Case for DoAll Precision Gage-blocks

## Kaufman Tapping Machine

A No. 10 Hi-Duty, single-spindle, lead-screw tapping machine built for continuous high production, yet sufficiently versatile to handle odd-lot work efficiently, is a recent product of the L. J. Kaufman Mfg. Co., Manitowoc, Wis. It is available in 3- and 1 1/2-H.P. models, with capacities for tapping 3/4- and 1 1/2-inch N.C. threads in alloy steel. This tapping machine is fully enclosed, and has a lead-screw and nut that operate continually in an oil bath. The clutch is instantly engaged and



Kaufman Single-spindle Lead-screw Tapping Machine

controlled by an air cylinder, and quick traverse of the spindle (when actual tapping is not being done) serves to increase production and at the same time provide accurate control when guiding the tap into or out of the work. There is no backlash between the lead-screw and nut threads.

Class 3 fit threads are always assured, and the depth is kept under accurate control. The tap is provided with overload protection, and the lead-screw and spindle are protected against jamming in the event that the work is placed in the fixture upside down, as the spindle will only proceed downward if the tap can enter the hole to be threaded. Special models include multiple heads and index tables. ..83

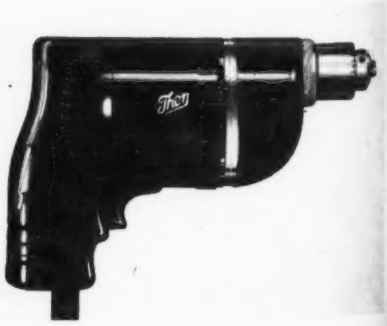
H & H Portable Electric Tool

## Portable Reciprocating-Action Electric Tool

Two new models of a push-and-pull action portable electric tool for filing, burring, chamfering, honing, polishing, lapping, scraping, sawing, and sanding have been announced by the H & H Research Co., 438 Marquette Bldg., Detroit, Mich. These models have a new pistol grip with a conveniently located finger control switch. The fan air inlets and outlets are of larger capacity to insure improved cooling. A spiral wire cord protector prevents the flexible cord from slipping in or out and protects it from damage. A heavier armature is used, and the work-spindle has three bushings instead of two, as in the older models. One of the new models has a 3/8-inch stroke, while the other has a 1/8-inch stroke. Each stroke exerts a 30- to 40-pound push or pull. .....84

## Thor Electric Drill with Plastic Housings

A 1/4-inch capacity electric drill that is 14 per cent lighter and has more power per pound than preceding models, has been added to the line of Independent Pneumatic




Light-weight Electric Drill with "Thorite" Plastic Housings



To obtain additional information on equipment described on this page, see lower part of page 180.

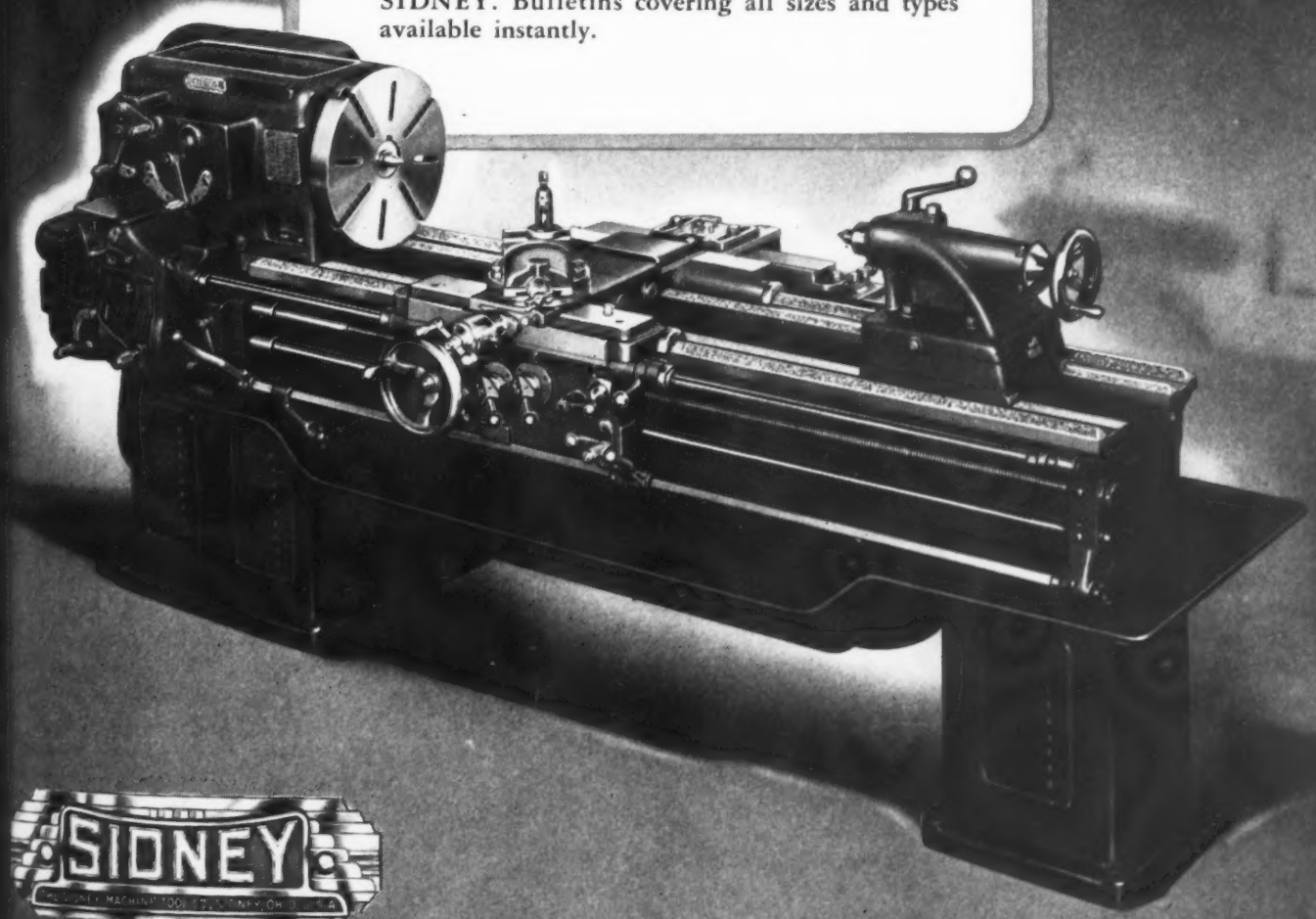
# Brings Power-Speed-Accuracy to War Production Plants

## SIDNEY LATHES

In hundreds of plants producing all manner of War material from guns to airplanes Sidney Lathes are faithfully producing a wide variety of parts, to close tolerances and maintaining rigid accuracy over long periods.

Ease of operation—sixteen speeds and forty-eight changes of threads and feeds provide maximum possibilities of all types of cutting tools. Smooth flow of power through continuous tooth herringbone geared headstock—the additional center bearing for spindle and intermediate shaft assures the utmost in rigidity and accurate, smooth finished work.

From the standpoint of continued precision, versatility and ultimate low costs make your next lathe SIDNEY. Bulletins covering all sizes and types available instantly.



SIDNEY

The SIDNEY MACHINE TOOL Company

*Builders of Precision Machinery*

SIDNEY — ESTABLISHED 1904 — OHIO

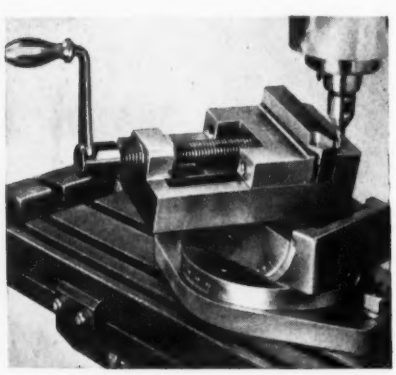
Tool Co., 600 W. Jackson Blvd., Chicago, Ill. The "armored in plastic" construction of this new drill provides double protection to the operating parts within an inner metal skeleton frame that is covered by entirely separate plastic housings. Fast drilling can be performed with this drill because of its light weight and easier handling features.

The Thorite plastic housings—the field case, gear-case, and grip handle—serve solely as protective coverings. They do not support any of the operating parts, but simply slide into position over the skeleton frame. In fact, the drill can be operated with the plastic armor entirely removed. The new drills weigh only 3 1/4 pounds, are 8 3/16 inches long, and are available with three speeds of 2500, 3750, and 5000 R.P.M. .....85

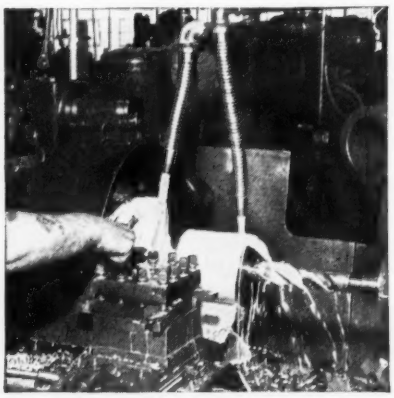
## Wesson Precision Vise and Angle-Plate

A universal precision machine tool vise for angular milling, drilling, grinding, boring, and other operations is manufactured by the Wesson Co., Ferndale Station, Detroit, Mich. This vise can be quickly set to the most complicated compound angles with a high degree of precision. In addition to the operations referred to, it can be used for reaming, slotting, buffing, tapping, honing, spot-facing, counterboring, lapping, superfinishing, grooving, planing, shaping, die-sinking, and other operations.

The vise swings through an angle of 180 degrees in the top plane, 90 degrees in the vertical plane, and 360 degrees in the bottom plane, and is completely graduated in all planes. Vernier graduations for use where extreme precision is required are available at extra cost. This vise is made in two sizes—a No. 1 having jaws that open up to 4 inches and that is 6 1/8 inches high, and a No. 2 with jaws that open up to 1 3/8 inches and that is 4 3/8 inches high. .....86



Wesson Machine Tool Vise for Angular Machining Operations



Flexible Coolant Spout Made by J. N. Fauver Co., Inc.

## Bullseye Coolant Spout

An improved Bullseye coolant spout that can be readily adjusted to any position for directing the coolant stream directly on the tool has been brought out by the J. N. Fauver Co., Inc., 41 W. Hancock Ave., Detroit, Mich. Because of the flexibility of this spout, elbows, tees, ells, connectors, and adapters for rigid piping are eliminated.

These spouts are available in sizes ranging from 1/8 to 3/4 inch inside diameter and in any length. They are rustproof, leakproof, and scaleproof. These improved spouts are also suitable for use with oil, air, water, steam, or grease. .....87

* * *

## Data on NE Steels

The American Society for Metals, 7301 Euclid Ave., Cleveland, Ohio, has brought out a new edition of the pamphlet on "National Emergency Steels." The new edition gives the latest data on these steels, including a revised list of the chemical composition of the different NE steels; results of tests on physical properties; heat-treatment; suitability of the various types for different classes of work; and much other essential information. Copies can be obtained from the Society at 50 cents each.

## Training Film on Atomic-Hydrogen Arc Welding

An all-color sound movie entitled "The Inside of Atomic-Hydrogen Arc Welding" has been made available by the General Electric Co. to help in the training of men and women welding operators using this process in the war industries. The film can be obtained for single showings, or bought at "print" cost, by addressing the General Electric Visual Instruction Section, Schenectady, N. Y., or the nearest General Electric office.

* * *

## Die Cushion Model

A die cushion working model cut out and assembled in cardboard, is being distributed by the Dayton Rogers Mfg. Co., 2835 Twelfth Ave. S., Minneapolis, Minn. This model shows the details of pneumatic die cushion equipment as applied to an average punch press. The model is of laminated cardboard, 8 1/2 by 11 inches, and through the use of spring-operated moving parts, it illustrates the working principles of pneumatic die cushion equipment and illustrates how a single-action press may be used in place of a double-action press or how a double-action press can be used in place of a triple-action press. The model will be sent on receipt of requests written on company letter-heads.

* * *

## Die Costs Reduced 65 Per Cent

To meet the demand for faster production of blanking and piercing dies, Algoma Products, 3080 East Outer Drive, Detroit, Mich., are now manufacturing dies by the templet method. This process is said to reduce the cost of dies approximately 65 per cent. The dies are produced from templets of the parts to be blanked. Instead of milling the dies, they are contour-sawed from chromium-molybdenum steel, filed, sheared to size, hardened, and welded to inexpensive back-up plates. One-third of the alloy steel required in conventional dies is saved by this method. These dies can be applied to either single, compound, or progressive operations for blanking and piercing sheet stock.



To obtain additional information on equipment described on this page, see lower part of page 180.

# At night on a lonely beach

*Landing boats and tank lighters are grounding on the beach and our army is establishing a beach head. This scene has been enacted at Guadalcanal — in North Africa and at little-known harbors in New Guinea.*

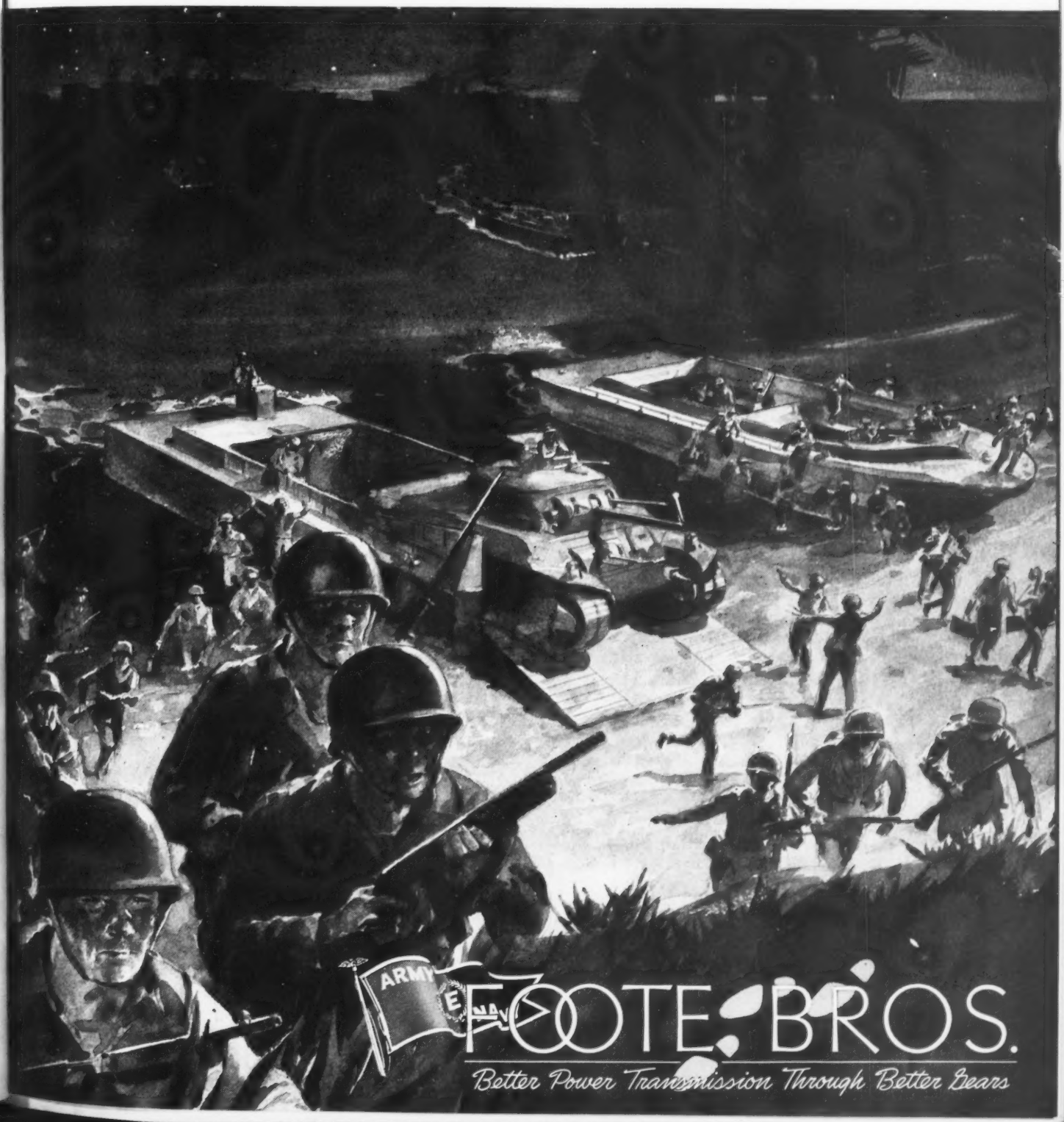
Dim shadows—low on the horizon—waves foaming on a sandy beach—then pushing through the darkness, landing barges bring threat of invasion to Axis-ruled lands!

Built to battle pounding surf—made to stand the jarring impact of landing—tough is the word for these barges. And tough is the word for the giant gears that drop their anchors and raise them. In fact, so tough are the blanks for these gears that cutting them was deemed an impossibility. Foote Bros. engineers and Foote Bros. workmen changed the conception of what was possible. And today, the landing barges which are keeping Hitler's armies pinned to the coast from Narvik to Tripoli give evidence of how well these special problems were solved.

Here at Foote Bros. new techniques and new manufacturing know-hows are responsible for gears and speed reducers of radically different design and construction—gears light in weight and of extreme precision for aircraft engines—gears of giant size and super toughness designed to stand the grueling punishment that only war can give.

But when the war is won and these same techniques can be applied to peacetime use, American manufacturers may look forward to revolutionary developments in all phases of power transmission.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 South Western Boulevard • Chicago, Illinois



# Wet Grinding Improved by Wetting-Action Compound

By Dr. R. W. MITCHELL, Technical Director
Magnus Chemical Co., Garwood, N. J.

MANY of the troubles encountered in wet grinding operations can be reduced—and in some cases eliminated—by increasing the "wetness" of the grinding fluid. This may seem a rather queer statement if one assumes that water or a cutting fluid is as wet as it can be. As a matter of fact, that assumption is not correct. Water can be made considerably "wetter" by the use of a wetting agent.

The reason that water is not as wet as it might be is because of the property of surface tension inherent to water and all other liquids. It is this property that enables one, for example, to make a needle float on water. The surface tension creates a sort of skin on a liquid. Anything that will reduce the surface tension makes it easier to penetrate this surface skin. The fluid whose surface tension is reduced will wet things much faster.

There are many synthetic wetting agents that make water or other cutting fluids materially wetter; but these agents vary greatly in their properties—some are acid, some neutral, and some alkaline. Some foam and some do not. For wet grinding, the agent should be a stable, non-foaming, non-corrosive compound. The addition of as little as one ounce of this type of compound to a gallon of soluble oil solution will give remarkable results. In cases where this compound is not added to the cutting fluid, it is usual, when a machine is stopped to gage a part, to find that the surface of the work is not wet all over with the solution, but spotted with drops of the solution. Furthermore, there is a tendency for chatter marks and burned streaks to appear.

When the wetting compound has been added as mentioned, the solution clings to the wheel, the work is wet all over, chatter marks and burned streaks are reduced, and the grinding operation can be speeded up materially, with the result that the finished surfaces are smoother. Furthermore, the wheel stays clean much longer and requires less frequent dressing. Those who have used this method also report that there is less tendency for rust streaks to appear on the work or on the machine.

One precaution must be emphasized in connection with the use of this wetting compound. Care should be taken to see that the solution does not get into the gear-box. The improved wetting action has a tendency to wash the oil and grease out of the gear-box. As a matter of fact, the ordinary soluble oil solution is none too stable in a gear-box; but when made "wetter" by the compound, this tendency is greatly accelerated.

## The Importance of Saving Paper in the Industries

Wood pulp production has been seriously curtailed by reduction in the available working forces and by transportation limitations. The war has cut off the imports of wood pulp from the Scandinavian countries which in peacetime constituted an appreciable percentage of the total supply of the United States.

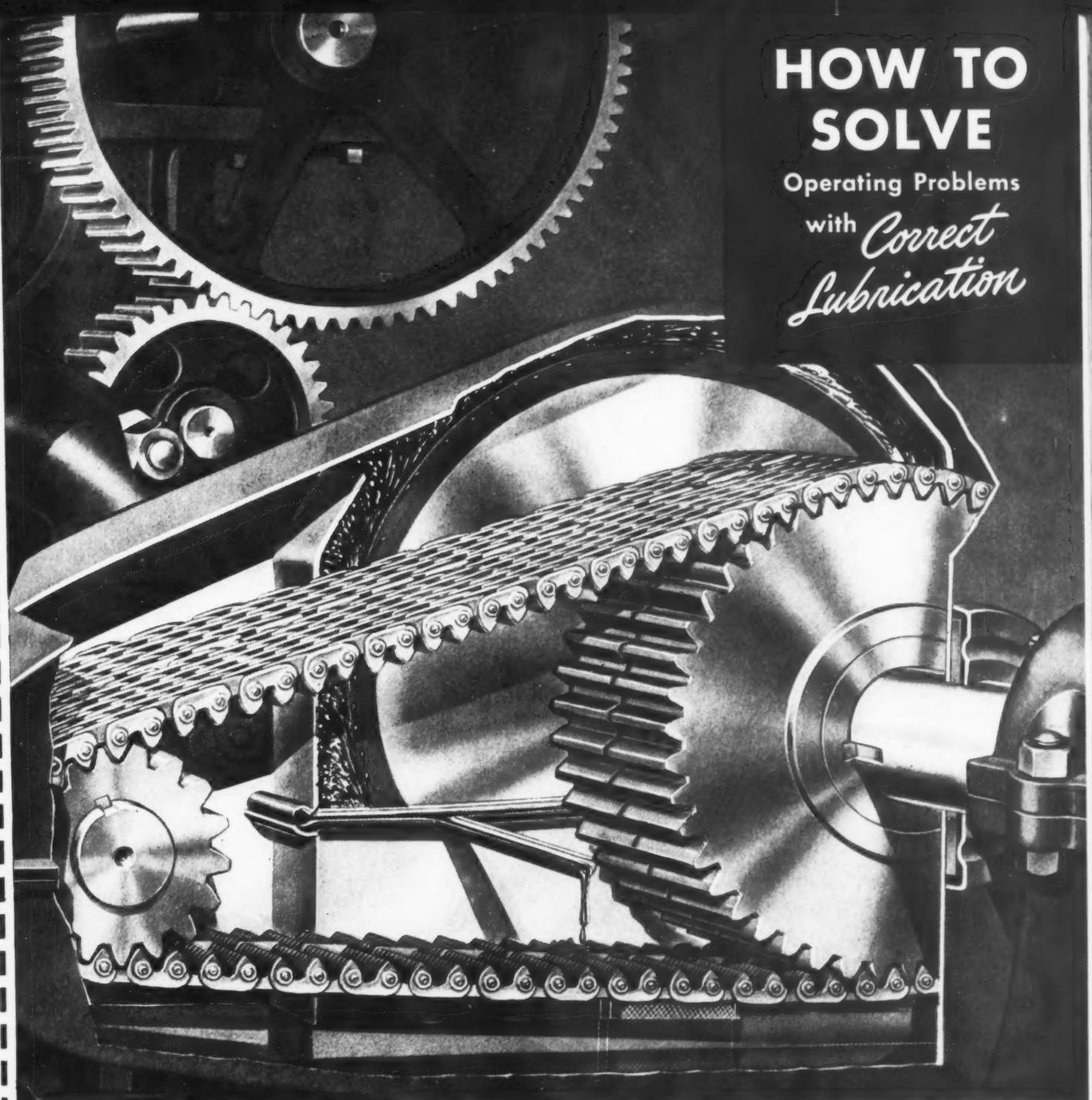
Under present conditions, the Government is using far more paper than normally; it is said that about 10 per cent of the total wood pulp of the country is required for the paper used by the Government. Business, industrial, and engineering publications have reduced their use of paper by a minimum of 10 per cent, and sometimes by a larger percentage.

The management of an industrial plant can do a great deal to help conserve paper. An important point in the conservation of commercial paper is the "down-grading" of paper qualities. It is believed that most of the paper used for industrial records and for business correspondence is much heavier and better than is needed for the purpose—at least, during the wartime emergency. This is also true of many plant magazines, Army-Navy "E" award programs, circulars, and other publicity material.

The suggestion has been made that the management of industrial plants should ask these questions with regard to the paper for all written or printed matter that it uses: (1) Is it necessary? (2) Can lighter paper be used? (3) Can a smaller size sheet be used? (4) Can the number of printed pieces be reduced by pruning the distribution lists? (5) Is an excessive inventory of paper kept on hand? At present, a sixty-day supply is the allowable margin, compared with a six months' peacetime average.

The War Production Board has urged that a competent operating executive be made responsible for the saving of paper in each plant. The following suggestions have been made:

1. Use 3 1/2- by 5 1/2-inch letterheads for short letters, and mail them in small envelopes.
2. Review all printed forms periodically to determine whether they are essential, whether they can be consolidated, and whether waste space can be eliminated. Standardize size, weight, color, and grade of paper used, and eliminate color whenever possible.
3. Use smaller type sizes and margins.
4. Use thinner paper whenever possible.
5. Condense letters and memoranda by making the margins as narrow as possible, using a single space between lines, and using the reverse side of incoming letters as the carbon copy of replies. Use both sides of all mimeographed sheets.
6. Control the disbursement of paper supplies to departments so that excessive quantities will not accumulate in desks or supply closets.
7. Make scratch pads from stocks of obsolete letter-heads, memorandum forms, etc.
8. Use and re-use carbon paper to the fullest extent.



# HOW TO SOLVE

Operating Problems with *Correct Lubrication*

# Keep this "Chain Gang" Tough!

MODERN CHAIN DRIVES are playing an important part in maintaining wartime production. They have been designed to take heavy loads at high speeds. They'll do their job week after week if given proper service and lubrication.

First, keep your chain drive in proper mechanical condition and correct adjustment, then the next step is... **USE GARGOYLE VACUOLINE OIL** for the type of lubrication shown above. This oil will penetrate the close clearances between the pins and bushings. It will provide a dependable, protective oil film... assure minimum maintenance...maximum oil life. There's the type lubrication you're looking for.

GARGOYLE Lubricants

**SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Magnolia Petroleum Company • General Petroleum Corporation of California**

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

## CALL IN SOCONY-VACUUM

## Army-Navy "E" Production Awards

The management and employes of the following firms in the machine-building and allied fields, have recently been honored with the Army-Navy "E" production award:

American Gear & Mfg. Co., Chicago, Ill.

Ampco Metal, Inc., Milwaukee, Wis.

Cincinnati Planer Co., Cincinnati, Ohio.

Crucible Steel Co. of America (Park Works), Pittsburgh, Pa.

Defiance Machine Works, Defiance, Ohio.

Eclipse Counterbore Co., Detroit, Mich.

Firth-Sterling Steel Co., McKeesport, Pa.

Geometric Tool Co., New Haven, Conn.

A. F. Holden Co., New Haven, Conn.

Ladish Drop Forge Co., Cudahy, Wis.

Lufkin Rule Co., Saginaw, Mich.

Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

Pangborn Corporation, Hagerstown, Md.

Rockford Machine Tool Co., Rockford, Ill.

L. S. Starrett Co., Athol, Mass.

Union Metal Mfg. Co., Canton, Ohio.

## Violations of WPB Regulations

The War Production Board has requested publication of part of a letter that has been sent to all producers and distributors of gages and precision tools pertaining to the regulations of the Board. The object is to impress on all distributors and purchasers of precision hand tools the necessity of closer cooperation in observing the regulations, so that a more even distribution of tools can be accomplished. That part of the letter referred to reads as follows:

"It has been called to the attention of the Tools Division that war contractors have been issuing 'blanket' purchase orders to distributors of gages and precision hand tools, applying to such orders the contractor's maintenance, repair, and operating supplies preference rating for tools to be held in the distributor's stock for sale exclusively to the particular contractor's employes.

"Such practice is a direct violation of Priorities Regulation No. 3, as well as General Preference Order E-5-a. No person may apply a rating to secure material being purchased not by the person applying the rating, but on the contrary being bought and paid for by a third person. The only mechanism under which the contractor's rating may be used is that established by E-5-a.

"Any distributors who have stocks of precision tools so earmarked for a specific contractor's employes must make these tools available to any approved user or employe in accordance with the terms of General Preference Order E-5-a. Continued violations will be submitted to the Compliance Division of the War Production Board. All purchase orders placed by you with any producer of gages and precision hand tools which were rated by your customer with such an understanding that they are to remain in your place of business as earmarked stock for such customer's employes should be cancelled immediately.

"Any questions concerning this letter or the amended E-5-a should be directed to Sam Wood, Gage and Precision Tool Section, Tools Division, War Production Board, Washington, D. C. The letter should be marked 'Reference: E-5-a.'"

* * *

## Increasing Die Life in Hot-Forging of Shells

In hot-forging processes—especially in shell production—the punches, mandrels, and rings are swabbed or sprayed with a material that prevents carbon build-up and scratches, thereby promoting speed of production and increasing die life. A series of hot-forging "agents" to meet the demands of munitions production requirements has been developed by E. F. Houghton & Co., Philadelphia, Pa. The necessary graphite content, high flash point, and "wetting-out" action are combined in a material that will not build up on the ram or cause scoring.

## Lincoln Awards

Herman J. Brenneke, of New York University, won the first award of $1000, and the additional honor of having four scholarships worth $250 each presented in his name to the university's engineering department, for his paper entitled "Arc Welding versus Casting in the Design of Jigs and Fixtures," submitted in the engineering undergraduate award of the James F. Lincoln Arc Welding Foundation, Cleveland, Ohio.

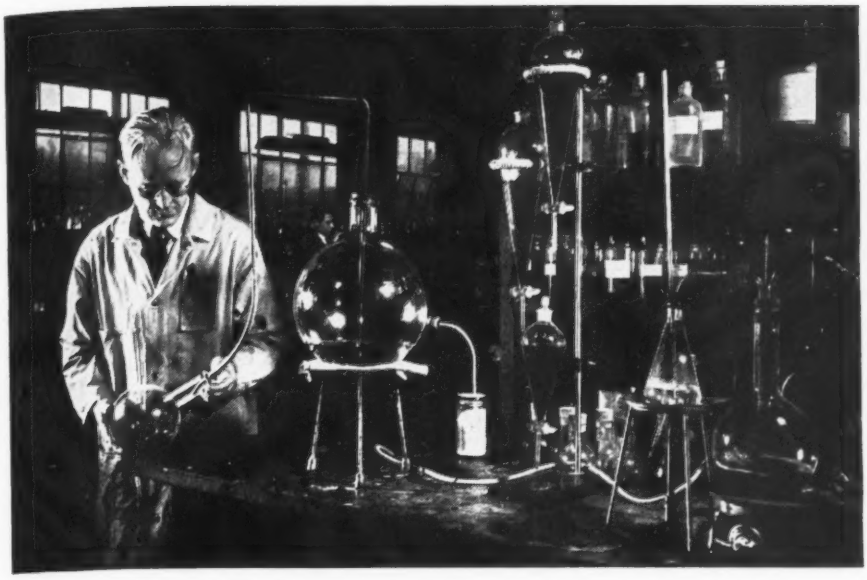
The second award of $500 and the additional honor of two scholarships worth $250 each presented in his name to the university's architectural engineering department were awarded to Robert Edson Lee of Iowa State College, Ames, Iowa, for his paper "An Arc-Welded Chair." The third award of $250 and a $250 scholarship presented in their names to the university's department of civil engineering were awarded jointly to Charles L. Sammons and John H. Stewart, of Ohio State University, Columbus, Ohio, for their paper on "Application of Arc Welding to the Design and Construction of a Radio Tower."

* * *

## Pneumatic Chip Collector

Roger Greene, a tool designer at the Schenectady Works of the General Electric Co., has devised a pneumatic chip collector that provides automatic and complete salvage of an important material. The device has been applied to an automatic lathe used for machining the bore of babbitt-lined steel shell motor bearings. A jet of air is used to blow the chips into a covered barrel at one end of the machine. Ordinarily, because babbitt is machined at relatively high speeds, the chips fly all over the floor around the machine, and may be mixed with other matter when they are shoveled up for salvage.

The automatic lathe referred to has a hollow spindle, which was originally piped for cutting oil. By connecting this oil piping system of the machine to the shop air line, a stream of compressed air is directed to the bearing during the boring operation. The air is turned on and off automatically as the turret indexes. It carries the chips through the spindle to a sheet-iron pipe leading into the chip barrel.



**A Few Products of QUAKER CHEMICAL RESEARCH:**

New type cutting fluids to replace oils on all machining operations.

•

Wax, grease and oil-type corrosion resisting coatings.

•

Products for cleaning and rustproofing in one operation.

•

Water soluble solvents to replace degreasers and alkaline baths for metal cleaning.

•

Modern emulsoid solutions for grinding.

•

Compounds for drawing, stamping and forming of all metals.

•

Special chemicals and oils for every metal processing operation.

# *Quaker Chemical puts the* EMPHASIS ON RESEARCH

**Develops products and processes to overcome problems heretofore inadequately dealt with**

MORE THAN a decade ago, we at Quaker Chemical dedicated our organization to the task of locating processing problems in industry which we felt have never been handled quite satisfactorily . . . and to developing chemical products and processes that would overcome past troubles.

So, today, the heart of the Quaker Chemical organization is its laboratory—or, rather, its laboratories—for there are *two* separate "labs" at our Conshohocken plant. One, the Control Laboratory, inspects all incoming raw materials as well as our own finished products. The other, a corner of which is shown above, is devoted entirely to research and development.

Heading these two "labs" is an eminent scientist who has studied at four leading universities, both here and abroad, and who has personally been granted more than 40 practical patents.

The Research group comprises more than 25 chemists and engineers . . . most of whom have accompanied Quaker Process Engineers on their field service calls and are, therefore, familiar with metal processing and are able to envisage the practical side of every shop problem. Their work—which consists of both special problems and permanent projects directed toward basic research in corrosion, cutting, drawing and similar propositions—is carried on in a large, modern, open laboratory where every individual knows the work of the others. Whenever difficulty warrants consultation, informal round-table discussions are called at a moment's notice

In addition to the work of this group, Quaker Chemical also maintains fellowships and sponsors research projects in five leading universities.

Probably no other similar manufacturing organization devotes so large a proportion of its facilities and energies to research. That this policy has borne fruit is evidenced by the many new type Quaker Chemical products that have already won wide acceptance throughout industry.

Just how far-reaching will be the effect of some of these developments on metal processing remains to be seen. In some cases their performance has been truly outstanding . . .

**But rather than make extravagant claims for these products, we prefer to use this method of inviting you to establish contact with us . . . so that your plant may share immediately in whatever benefits emerge from Quaker's never-ending research.**

**A Quaker Process Engineer will gladly call and discuss with you just where our new developments may fit into your metal working picture. Simply write or wire—**

## QUAKER CHEMICAL PRODUCTS CORP.

CONSHOHOCKEN, PA.

OTHER PLANTS IN CHICAGO AND DETROIT

WAREHOUSE STOCKS IN PRINCIPAL INDUSTRIAL CENTERS

## Cementing Woven Cotton Belting for Power Transmission

Rather than replace old belt-driven machine tools forced into service by war production demands, the Westinghouse Electric & Mfg. Co. has obtained the most efficient operation from these machines by improving the present drives as much as possible.

In this connection, Max Kholas, of the Westinghouse organization, devised a method of splicing solid woven cotton belting. A patent has been granted on this process which provides a satisfactory flat belt drive, using no critical materials, and increases production through less slippage and less down-time due to broken belts. In addition, this type of belting cost less than other types. Very satisfactory results have been obtained.

This type of belting is now used on such machines as sensitive drilling machines, multiple-spindle drilling machines, profiling machines, automatic screw machines, grinding machines, heavy-duty air compressors, and belt conveyors. The belt sizes range from 3/8 inch to 84 inches in width and from 2 to 8 ply in thickness.

The method of cementing the belting is quite simple, and is done without special tools and expensive equipment. The actual splicing can be done right at the machine where the belt is to be used. This permits the use of cemented belting having the advantages of endless belts on machinery and equipment so constructed that endless belts cannot ordinarily be used.

## Semi-Annual Meeting of the A.S.M.E.

The semi-annual meeting of the American Society of Mechanical Engineers will be held at the Hotel Biltmore, Los Angeles, Calif., June 14 to 17. Sessions pertaining to aircraft production will constitute the main feature of the meeting. Airplane manufacture presents many problems in mechanical engineering all the way from the laboratory to the flight tests. Petroleum engineering will also receive considerable attention at the meeting. Other subjects will deal with management problems, the training of workers, and the substitution of women for men in shops and engineering offices. The technical program at the meeting will be unusually extensive.

* * *

## New Welding Library at Ohio State University

A new welding library, believed to be the most extensive in existence, has been established at the Ohio State University, Columbus, Ohio. Known as the A. F. Davis Welding Library, it is the gift of A. F. Davis, vice-president and secretary of the Lincoln Electric Co., Cleveland, Ohio. Mr. Davis graduated from the university with the degree of M. E. in electrical engineering in 1914. His chief reason for placing the library there is, however, that Ohio State University has the only four-year course in welding engineering in the country.

The library makes available in one place all important literature on welding, and will, therefore, be of special value to industrial designers, engineers, and others engaged in research, or to those who seek general information on welding and its application to the design, construction, manufacture, and maintenance of metal products and structures. Although just established, the library already contains over 700 volumes on welding, as well as bound volumes of welding magazines, and the award studies submitted to the James F. Lincoln Arc Welding Foundation.

## New Bearing Alloys Save Tin

According to the Battelle Memorial Institute, there are several alloys that can be employed as substitutes for the standard bearing bronze now in general use without sacrifice of the bearing qualities. What might be called a standard bearing bronze contains 80 per cent copper, 10 per cent lead, and 10 per cent tin. In the alternate compositions, the tin content may be as low as 2.8 per cent, and for some uses, a bearing alloy can be made with no tin at all. In fact, these new alloys have proved to be better for some purposes than the standard alloy. When the tin content is reduced as low as 2.8 per cent, antimony and copper are substituted in place of higher tin content. The Battelle Memorial Institute, Columbus, Ohio, has published a review of the investigations made.

* * *

## Price Discount on Carbide Tools

The Firth-Sterling Steel Co., McKeesport, Pa., manufacturer of Firthite sintered carbides, has announced what is known as a "Special 1943 War Discount." Because of the growth in the use of Firthite sintered carbides, it has been found possible to make this discount effective for the balance of the year. It applies to Firthite in all forms—tips and blanks, milled and brazed tools, general-purpose tools, and all standard and special tools manufactured by the company.

## Sweet's File for Product Designers

Sweet's Catalog Service, 119 W. 40th St., New York City, announces a new publication entitled "Sweet's File for Product Designers," containing 1500 pages, 8 1/2 by 11 inches, of condensed catalogue data obtained from 200 manufacturers, giving specific product information on materials, finishes, parts, techniques, and work equipment. Copies can be obtained without charge by qualified organizations or individuals who have continuous need for the information it contains.

The New Departure Division of the General Motors Corporation, Bristol, Conn., has prepared some unique weekly war production posters for use in their own plant, each of which shows the picture of a New Departure employe now in his country's service and contains a quotation from a letter received from him. A collection of these posters, reproduced in miniature, will be sent to anyone interested in using this idea.

# 1 SALT BATH CASING OF TOOLS

Molten salt bath treatment of tools after the regular cycle of heat treatment has been found to triple their life, and more! This nitride case is applied by a few minutes' immersion at 1000–1050° F., and provides a hardness up to 1100 Brinell. It does not change dimensions if the tool was correctly heat treated and tempered.

The increase in tool life is phenomenal. Spline broaches, for example, lasted for only 12 pieces in one plant. After nitriding the broaches they produced 300 pieces. Another user of Liquid Heat No. 720—the Houghton salt for this purpose—reports an increase from 100 shells per tap between grinds, to 2200 shells before grinding was necessary. In many instances, tool life has been increased 300% to 500%. Some plants make it a practice to treat all new broaches before using them.

The cost of this salt bath treatment is extremely low—the results extremely valuable in conserving precious tools. Write today to E. F. Houghton & Co. for your copy of paper presented at the A. S. T. E. Convention which describes this salt bath treatment in full detail.

## *Houghton offers 2 helpful ideas*

# 2 CAREFUL SELECTION OF CUTTING FLUIDS

With deliveries of tools nearly a year behind, and a half-million new machines recently put into production, *tools* are a bottleneck. One important way to preserve them is by the proper selection of modern cutting fluids.

Anti-welding properties are provided by carefully choosing the right type of sulphur addition. Extreme pressure properties have been built into the newer cutting oils, by using modern scientific additives which permit the oils to withstand tremendous pressures.

Viscosities must be right for rapid heat absorption. Carefully chosen additives permit the use of lighter colored oils, which means better visibility of the work.

Treatments developed in recent years by Houghton have been proven to impart properties of fine finish and longer tool life, as well as permitting that faster production so vitally needed to hasten the day of Victory.

### BUY THE BASE AND SAVE THE SPACE

Houghton Cutting Concentrates enable the user to purchase blending oil locally and save needed shipping space on crowded transportation lines. These bases are highly concentrated, enabling greater dilutions to fit the job. A selection to handle any machining operation can be made readily if you will consult the Houghton Man and get his recommendations.

**& CO.** **303 WEST LEHIGH AVE., PHILADELPHIA**

CHICAGO · DETROIT · SAN FRANCISCO · TORONTO

# News of the Industry

## Alabama

TOOL ENGINEERING SERVICE, 505 N. Twenty-second St., Birmingham, Ala., is a new concern organized to represent manufacturers of standard and special machines, gages, and industrial equipment. Among the firms represented by this concern are the Sheffield Corporation, Hannifin Mfg. Co., Charles H. Besly & Co., D. A. Stuart Oil Co., Empire Tool Co., Gairing Tool Co., and Modern Collet & Machine Co.

## California

FRANK H. ROBB has been made manager of the manufacturing and repair department of the Westinghouse Electric & Mfg. Co. for the Los Angeles area. In his new post, he will have charge of departmental activities, including the manufacture of new electrical equipment for war industries and the armed forces, as well as the maintaining and servicing of electrical apparatus already at work in industry and in the military and naval services. Mr. Robb succeeds CHARLES G. YARBROUGH, who has retired after being connected with the company for forty-seven years, thirty-one of which were spent at Los Angeles.

A. D. LEWIS has been appointed West Coast service and sales representative for the Progressive Welder Co., Detroit, Mich. He will make his headquarters at 4328 San Fernando Road, Glendale, Calif., and will cover the state of California. THE SHOEMAKER AIRCRAFT CO., 206 Lowman Bldg., Seattle, Wash., represents the company in Washington, Oregon, Idaho, and Montana.

S. LEROY CRAWSHAW has been made plant manager of the Lynwood, Calif., plant of the Western Gear Works. Mr. Crawshaw was previously connected for twenty-four years with the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

## Illinois

ALBERT S. RAIRDEN has been appointed sales manager of the Riehle Testing Machine Division of American Machine and Metals, Inc., East Moline, Ill. Mr. Rairden has been identified with the steel industry for twenty years, and is an authority on wire rope. For the last ten years, he has been associated with the Wickwire Spencer Steel Co.

AMERICAN MACHINE AND METALS, INC., East Moline, Ill., has been awarded the six months' production star to be added to the Army-Navy "E" flag presented to the company last September. Tolhurst Centrifugal Division is one of the divisions of the company participating in the award.

ROY E. SMITH has joined the executive staff of the Kelly O'Leary Steel Works, Chicago, Ill., as sales manager. Mr. Smith was formerly division manager of Armco Drainage and Metal Products, Inc., a subsidiary of the American Rolling Mill Co., Middletown, Ohio, with which company he had been connected for fourteen years.

W. B. MUSE has been appointed sales manager of Industrial Abrasives, Inc., 3724 W. 38th St., Chicago, Ill., manufacturers of coated abrasive disks. Mr. Muse was for several years sales manager of the Sterling Tool Products Co. of Chicago.

## Indiana

J. Y. DAHLSTRAND has been elected vice-president and CHARLES H. AMY treasurer of the Universal Gear Corporation, Indianapolis, Ind. Mr. Dahlstrand, who for the last five years has been chief engineer and director of sales of the corporation, was previously connected in engineering capacities with some of the country's most important manufacturing concerns. Mr. Amy has conducted his own public accounting business, and was associated with many industrial and financial organizations.

INTERNATIONAL MACHINE TOOL CORPORATION, Indianapolis and Elkhart, Ind., announces the election of the following officers: C. RUSSELL FELDMANN, president and chairman of the board; WARREN J. HANNUM, vice-president; CHARLES H. FOSTER, vice-president in charge of sales; JOHN HANCOCK, treasurer; H. E. HAMILTON, secretary and assistant treasurer; and R. L. DILLON, comptroller and assistant secretary.

BANTAM BEARINGS CORPORATION, South Bend, Ind., a subsidiary of the TORRINGTON CO., Torrington, Conn., for the last eight years, has been merged with the parent company and will henceforth be known as the BANTAM BEARINGS DIVISION OF THE TORRINGTON CO. The Bantam Bearings Division will retain its present personnel and continue operations from the South Bend headquarters.

## Michigan and Wisconsin

ALGOMA PRODUCTS has recently been organized at Detroit, Mich., for the large-scale manufacture of templet dies for the aircraft and similar industries, as well as fixtures. The company has taken over the former plant of the Weltronic Corporation at 3080 E. Outer Drive, and is also operating a second plant in the Detroit area. L. HOSTER is general manager of the new company. He was formerly in charge of manufacturing for the Progressive Welder Co. of Detroit. D. RAESIDE is chief engineer, and A. SHAW superintendent of manufacturing, both of whom were also previously connected with the Progressive Welder Co. EMIL HANSEN, formerly purchasing agent of the Weltronic Corporation, is in charge of purchasing for Algoma Products. The new company has taken over the Weltronic fixture division, and will continue to produce these fixtures at the Outer Drive plant.

ADAM MACKENZIE, vice-president in charge of manufacturing for the Carboloy Company, Inc., Detroit, Mich., was elected chairman of the Detroit Section of the American Institute of Mining and Metallurgical Engineers at the April meeting of this Section.

COASTER CRAFT CO., at present engaged in machine, tool, and war production work, is now located in a new plant at 7568 Paige Ave., Van Dyke, Mich. ROY E. WILLS is owner and manager of the company.

T. M. CUMMINGS has been appointed executive vice-president and general manager of the Progressive Welder Co., Detroit, Mich. Mr. Cummings has been vice-president of the company since it was founded.

TAYLOR MFG. CO., Milwaukee, Wis., announces that it has purchased the plant, equipment, and other assets of the WRIGHT RUBBER PRODUCTS CO., Racine, Wis. The Racine plant will resume the manufacture of the full line of Wright products as soon as it can be placed in condition, and will be known as the WRIGHT RUBBER PRODUCTS DIVISION OF TAYLOR MFG. CO. The Taylor Mfg. Co. also manufactures a line of compression mold plastics, as well as precision drill presses, hydraulic dynamometers, and static balancing machines.

LEIGH WILLARD has been elected a director of the Allis-Chalmers Mfg. Corporation, Milwaukee, Wis., to fill the vacancy created by the death of Max W. Babb.

# How to PREVENT THIS SABOTAGE to Your Screw Driving Army

## PHILLIPS SCREWS END DRIVER-SKIDS!

*Caught in the act* by the "frozen" action photography* of Gjon Mili, is a skidding screw driver . . . one of the meanest of saboteurs. Skidding drivers cause accidents that keep all too many workers away from assembly lines, nursing gouged hands. And, fear of such injury slows-down the work of countless others. Always present, the danger increases with rushed, inexperienced workers. So, it's doubly important today to specify Phillips Recessed Head Screws . . . which prevent driver-skids!

Automatic centering of driving force in the scientifically designed Phillips Recess eliminates all other screw driving troubles: the fumbling, wobbly starts . . . re-driving of slant-driven screws . . . removal of broken-head screws . . . reclaiming of marred parts. Fast, faultless driving becomes automatic, even for "green hands" Power driving becomes practical.

*They cost less to use!* Compare *driving* costs. You'll find that screw *price* is a minor part of total fastening expense . . . that it actually costs less to have the advantages of the Phillips Recess.

**Gjon Mili synchronizes exposures with lightning-like flashes of the stroboscopic light, to make skidding driver appear to stand still.*

## PHILLIPS *Recessed Head* SCREWS

### KEY TO FASTENING SPEED AND SAFETY

The Phillips Recessed Head was scientifically engineered to afford:

**Fast Starting** – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

**Faster Driving** – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

**Easier Driving** – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

**Better Fastenings** – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

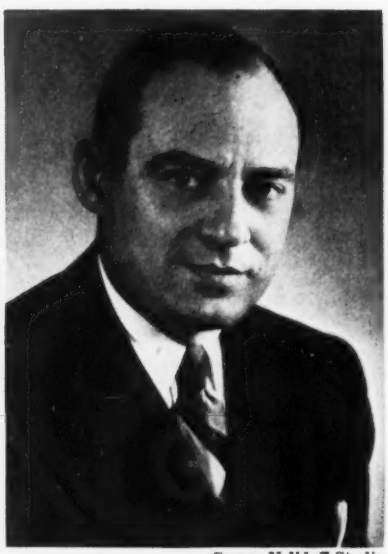
WOOD SCREWS • MACHINE SCREWS SELF-TAPPING SCREWS • STOVE BOLTS

21 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

## New England

JOHN W. HADDOCK has been elected president of the Farrel-Birmingham Co., Inc., Ansonia, Conn., and Buffalo, N. Y. Mr. Haddock was formerly vice-president of the Sullivan Machinery Co., Claremont, N. H. He started his industrial career as a stock clerk in the Michigan City plant of the Sullivan Machinery Co., and was advanced successively to offices of greater responsibility until, in 1935, he was made general manager of the Michigan City division. Since 1938 he has been vice-president in charge of engineering and sales for the company, dividing his time between the Claremont and Michigan City plants.



George Nelidoff Studio

John W. Haddock, Newly Elected President of Farrel-Birmingham Co.

J. M. MCLEOD, formerly assistant sales manager of Hardinge Brothers, Inc., Elmira, N. Y., is now associated with Ray H. Morris as district manager of the Hartford office of Hardinge Brothers.

NORTON CO., Worcester, Mass., has recently received its third award for production achievement. The original Navy "E" flag, awarded to the company on March 23, 1942, now carries two white stars on it, indicating that for three six months' periods the company has maintained its record for excellence in production.

## New Jersey

EARL S. PATCH has been appointed sales manager of Henry L. Crowley & Co., West Orange, N. J., manufacturers of the Crolite line of steatite high-frequency iron cores and powdered-metal parts and bearings. Mr. Patch was formerly with the Moraine Products Division of the General Motors Corporation, Dayton, Ohio, and has a thorough background of research, engineering, production, and application experience in the powdered-metals field.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa., announces that its district manufacturing and repair plant at Newark, N. J., has been awarded a star to be added to the Army-Navy "E" pennant presented to the plant last September for exceptional production of war materials. The star signifies that the company's high production record has been maintained for a period of six months.

WALTER J. DREVES has been appointed vice-president and comptroller of the Elastic Stop Nut Corporation, Union, N. J.

J. M. McLeod, New District Manager of Hartford Office of Hardinge Brothers, Inc.

## New York

FREDERICK R. LACK has been elected a vice-president of the Western Electric Co., 195 Broadway, New York City. Mr. Lack has been with the company for thirty-one years, except for two brief intervals—one when he enlisted in the Signal Corps and saw action in France during the first World War, and again while, for about six months, he was director of the Army and Navy Electronics Procurement Agency in Washington during the present war. Mr. Lack entered the manufacturing department of the Western Electric Co. in 1911 as an assembler. In 1923, he entered Harvard as a special student and obtained his B.S. degree with high honors in two and one-half years.

J. H. WILLIAMS & CO., manufacturers of drop-forgings and drop-forged tools, announce the removal of their stock products sales offices from 225 Lafayette St., New York City, to their plant at Buffalo, N. Y. on June 1. A local sales office will be maintained at the Lafayette St. address to serve the Metropolitan area only.

HERBERT M. RICH, JR., has been appointed district manager in New York for the Electro Metallurgical Sales Corporation, a unit of the Union Carbide and Carbon Corporation. Mr. Rich was formerly with Hickman, Williams & Co., Detroit, Mich., in charge of the sale of ferro alloys, pig iron, and metallurgical coke.

HEYMAN CO., builder of automatic machinery, has moved into new and larger quarters at 145 Hudson St., New York City.

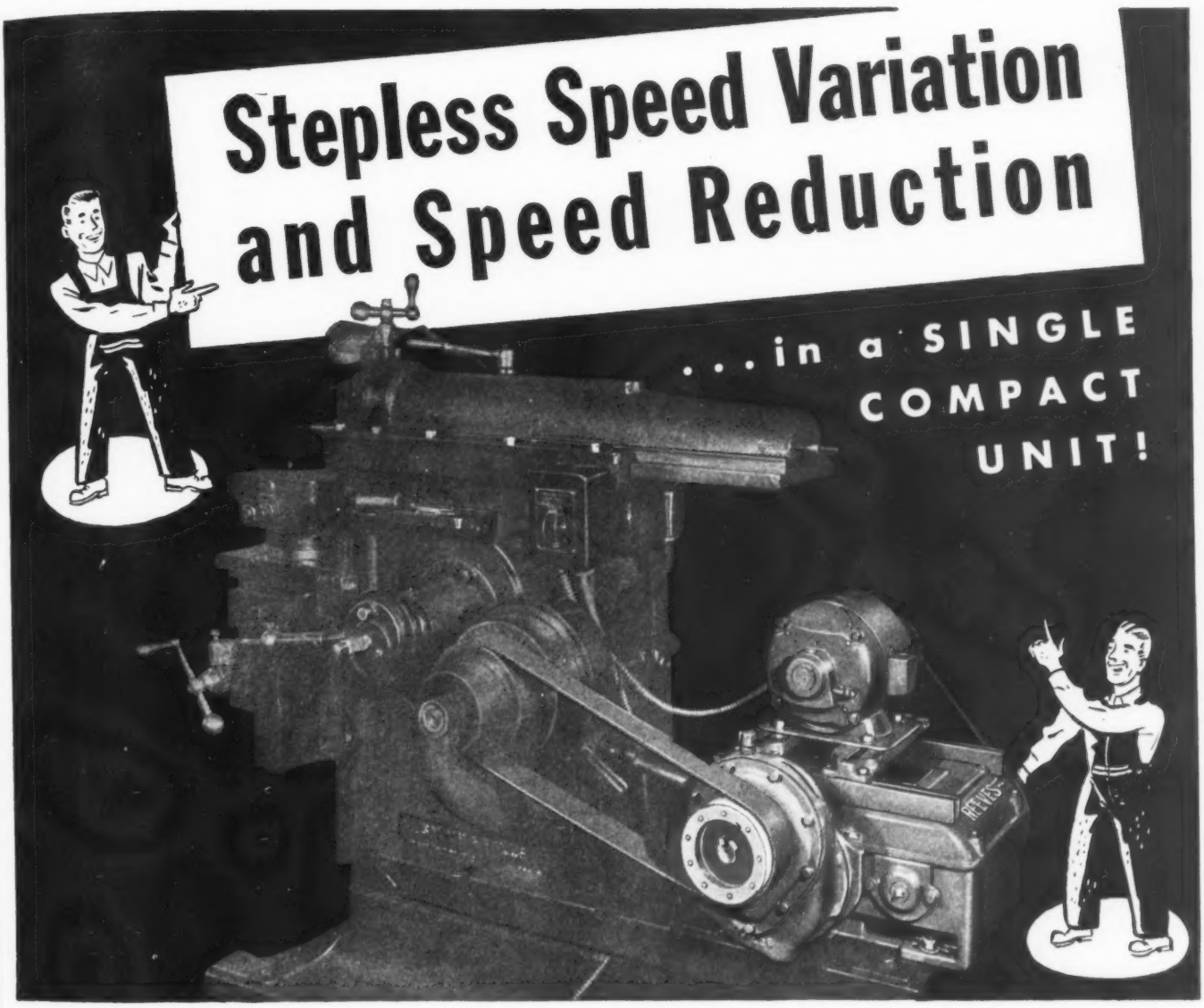
PORTMAN MACHINE TOOL CO. announces that it has moved to its own factory at 70 Mill Road, New Rochelle, N. Y.

## Ohio

BERNARD N. BROCKMAN has been made vice-president and general sales manager of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, filling the vacancy created by the death of H. C. Pierle. For the last eight years, Mr. Brockman has been in charge of the company's Chicago office. Prior to that, he was connected with the Federal Machinery Sales Co., a LeBlond representative, for sixteen years, taking that position after spending five years in the manufacturing and in-

Bernard N. Brockman, New General Sales Manager of the R. K. Le Blond Machine Tool Co.

# Stepless Speed Variation and Speed Reduction




Pictured here is a REEVES Reducer-Type Transmission, horizontal design, with individual motor drive, applied to a shaper.

With this new REEVES drive, which consists of the famous REEVES Variable Speed Transmission and built-in, helical-type speed reducer, operator of any production machine has a wide range of low driving speeds instantly available in a single compact unit.

The entire range is covered without steps or jumps. Any required speed for best production under each changing condition is accurately obtained by turning a handwheel, without stopping driven machine or interrupting production.

It's easy to equip the REEVES Reducer-Type Transmission for individual motor drive by means of REEVES adjustable motor base, which will accommodate any available motor. Send for complete information. Use handy coupon below.

Vertical design is especially adapted for use where floor space is limited.

## REEVES *Accurate-Variable* SPEED CONTROL

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Send copy of 16-page Catalog MTR-432 giving complete engineering information on the new REEVES Reducer-Type Transmission.

NAME OF FIRM.....

INDIVIDUAL.....ADDRESS.....

CITY.....STATE.....

spection departments of the LeBlond Cincinnati plant. DONALD WHITACRE will succeed Mr. Brockman in charge of the Chicago office. He has been connected with the LeBlond organization for seventeen years, and has been located at the Chicago office since it was opened in 1935.

JOHNSTON & JENNINGS CO., 864 Addison Road, Cleveland, Ohio, has purchased the exclusive manufacturing and sales rights for "Rusta-Restor," a cathodic (electrical) process for preventing rusting of water tanks, piping, and similar steel structures. This process, it is stated, has been tested and approved by the American Water Works Association, Factory Mutual, and other laboratories.

W. O. LIPPMAN has been appointed manager of the Canton Ordnance Division, Canton, Ohio, of the Westinghouse Electric & Mfg. Co. For the last four years, Mr. Lippman has been works manager of the Westinghouse Electric Appliance Division's plant in East Springfield, Mass. He has been with the Westinghouse organization since 1918.

E. ROBERT ISBELL has been appointed division manager of the Aviation Corporation, Toledo, Ohio, in charge of its subsidiary, the American Propeller Corporation and of its Liquid Cooled Engine Division.

## Pennsylvania

WILLIAM H. HARMAN has been elected president of William Sellers & Co., Inc., Philadelphia, Pa., builders of machine tools, special machinery, and locomotive injectors. Mr. Harman has been associated with the Baldwin Locomotive Works since 1928, and during the last five years served as vice-president in charge of sales for the Baldwin group. From 1915 to 1928, he was president of the Southwark Foundry & Machine Co., now a division of the Baldwin Locomotive Works. He remains a director of the Baldwin Locomotive Works. Mr. Harman is president of the Diesel Engine Manufacturers' Association, and a member of the American Society of Mechanical Engineers.

William H. Harman, Newly Elected President of William Sellers & Co., Inc.

C. E. POWELL has been appointed manager of the machinery department of the R. D. Wood Co., Philadelphia, Pa. He has been with the company since 1936. In addition to having made numerous improvements and secured patents on machine and control designs, he has contributed many ideas during the present war to high-speed press design and press control for the hydraulic forging of non-ferrous and aircraft metals. Mr. Powell was graduated from the Carnegie Institute of Technology in mechanical engineering in 1919.

Underwood & Underwood

C. E. Powell, Newly Appointed Manager of Machinery Department of R. D. Wood Co.

MCKENNA METALS CO., 147 Lloyd Ave., Latrobe, Pa., announces the appointment of six new representatives as follows: FREDERICK J. LEONARD CO., 514 Eighteenth St., Denver, Colo.; BERNHARD MINCH, P. O. Box 823, Tudor Arms Hotel, Buffalo, N. Y.; P. D. BROWNE, 1124 Allen Bldg., Dallas, Tex.; M. L. RATCLIFF, 422 Smith Tower, Seattle, Wash.; W. G. TODD ENGINEERING SALES CO., 308 Corandelet Bldg., New Orleans, La.; and W. E. SEIBOLD ENGINEERING SALES CO., 14 E. 18th St., Tulsa, Okla.

EVERETT CHAPMAN, who has been president of Lukenweld, Inc., Coatesville, Pa., since 1936, has resigned to establish his own consulting engineering business. Lukens Steel Co. will be among his clients. Pending election of a successor to Mr. Chapman, G. DONALD SPACKMAN, who was recently elected vice-president in charge of operations, will be in charge of the administration of Lukenweld, Inc. Mr. Chapman is a graduate of the University of Michigan, class of 1923.

GORDON LEFEBVRE has been elected president and general manager of the Cooper-Bessemer Corporation, Grove City, Pa., succeeding B. B. WILLIAMS, who will continue to serve as chairman of the board. Mr. Lefebvre previously held the position of vice-president and general manager. He has been with the company for a year and a half.

# Coming Events

JUNE 2-3—Diesel Engine and Fuels and Lubricants Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Carter, Cleveland, Ohio. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

JUNE 7-9—Annual convention of the AMERICAN ELECTROPLATERS' SOCIETY at the Hotel Statler, Buffalo, N. Y.

JUNE 9-10—War Materiel Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

JUNE 14-16—Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Los Angeles, Calif. C. E. Davies, secretary, 29 W. 39th St., New York City.

SEPTEMBER 30 - OCTOBER 2 — Aircraft Engineering and Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

DECEMBER 6-11—NINETEENTH EXPOSITION OF CHEMICAL INDUSTRIES at the Madison Square Garden, New York City. For further information, address International Exposition Co., 480 Lexington Ave., New York City.

* * *

No amount of man-power can take the place of intelligent planning. — *George T. Trundle, Jr.*

# THE ANSWERS TO QUESTIONS LIKE THESE:

## *What is "Gear-Shaving"?*

How does it work?
How accurate is it?
How does it compare with other methods?

## *Where Can It Be Used?*

What kind of gears can be shaved?
Who is using "gear-shaving" today?
How many machine types and sizes are there?
How big a gear can be finished by "shaving"?
How small a gear can be finished by "shaving"?

## *What About Cost?*

How many different gear sizes and types can be finished on one machine?
When should a rack or a rotary machine be used?
What tool life can be expected?
What does it cost to shave gears?

## *How Do You Use It?*

How do you set up to shave different gear types?
What controls gear accuracy in "gear-shaving"?
What machine type should be used for any given class of gears?
How does it affect gear design?
How does the use of "gear-shaving" affect preliminary gear cutting operations?

## *What About Curve Shaving?*

When should "curve shaving" be used?
When should "curve shaving" not be used?

These and numerous other questions are answered in a new booklet just made available by Gear Production Headquarters. Write for a copy on your company letterhead. Ask for Manual No. GF-43.

## MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD . . . DETROIT, U. S. A.

BUY U.S. BONDS STAMPS

# New Books and Publications

THOMAS' REGISTER OF AMERICAN MANUFACTURERS (1943). 5600 pages, 9 by 14 inches. Published by Thomas Publishing Co., 461 Eighth Ave., New York City. Price, $15 (renewals, $10).

Those who have been accustomed to using this comprehensive guide covering all the manufactured products of the United States would find it difficult to do without it. Especially in these days when sources of supply are limited by war demands, there is need for an up-to-date list of all possible sources. This well-known directory consists of five principal sections—first, a general alphabetical index (or finding list) of all manufactured products in the United States; second, a classified list of manufacturers arranged according to product, as well as geographically, and thoroughly sub-classified so that a particular class of product can be rapidly located; third an alphabetical list of manufacturers, giving product, branch offices, subsidiaries, and in some cases, names of officers; fourth, an alphabetical list of trade names. The various sections are printed on different colored paper for ready reference. An appendix gives a list of representative banks, boards of trade, chambers of commerce, and similar commercial organizations, and trade papers.

Briefly, the primary function of the book is to provide a list of all sources of supply for purchasing and purchasing research activities of office and plant men. Other uses include the determining of addresses of firms, locating successors to discontinued firms, and making lists for sales purposes. A valuable feature of the book is the capital rating, which gives an idea of the size of the concern. The data is compiled and revised with great care.

TOOL DESIGN. By Cyril Donaldson and George H. LeCain. 443 pages, 6 by 9 1/4 inches. Published by Harper & Brothers, 49 E. 33rd St., New York City. Price, $3.75.

This book is one of the Rochester Technical Series developed to provide teaching material closely related to the actual requirements of the various jobs in industry. General methods of tool design, which enable the student to develop ideas into practical specifications for modern manufacturing methods, form the basis of this volume. While the contents are intended primarily for persons preparing for the position of tool designer, others, such as tool engineers, toolmakers, time-study men, production supervisors, and other technical workers will find many suggestions of help in solving technical problems.

The text is divided into seventeen chapters dealing with the following phases of the subject: Drafting-room practice; manufacturing processes as they affect the designer; properties of materials; tolerances and allowances; springs; welding; cutting tools; punch and die design; gage and gage design; elementary jigs and fixtures; details of jigs and fixtures; practical design of jigs and fixtures; construction of Brown & Sharpe automatic screw machine; tools used on Brown & Sharpe automatic screw machine; cam design; and turret lathes.

FUNDAMENTAL SHOP TRAINING. By John T. Shuman, Captain Bailey Wright, and James Ritchey. 327 pages, 6 by 9 inches. Published by the American Technical Society, Drexel Ave., at 58th St., Chicago, Ill. Price, $2.

This book has been written especially as a pre-induction text-book for those preparing for war service. It is designed to provide a brief, intensive course in fundamental shop techniques intended to develop manipulative skill and to impart a knowledge of the qualities and characteristics of materials and of construction processes and procedures. The subjects covered are: Common hand tools; chipping, filing, and scraping; hand threading; linear measurement; drilling machines; the engine lathe; airplane construction; cable splicing; electrical wiring and splicing; woodworking; painting—wood preservation; rope, splices, and knots. A work-book is issued as a supplement to this text-book containing laboratory and project problems and a complete class-room study program.

APPLIED KINEMATICS. By J. Harland Billings. 320 pages, 6 by 9 inches. Published by the D. Van Nostrand Co., Inc., 250 Fourth Ave., New York City. Price, $3.25.

This is the second edition of a book on applied kinematics for students and mechanical designers. To meet the urgent demand of present engineering practice for more comprehensive education on acceleration, that topic has been given special attention, and much illustrative problem material has been included. A separate chapter has been added on the theory and application of the phorograph—a device for finding velocities in mechanisms. At the end of each chapter, questions and problems are given to test the student's understanding of the principles brought out. All material and problems have been related as far as possible to engineering practice. Special attention has also been given to graphical methods.

TOOL STEEL SIMPLIFIED. By Frank R. Palmer. 315 pages, 6 by 9 inches. Published by the Carpenter Steel Co., Reading, Pa. Price, $1, postpaid in the United States; $3.50 elsewhere.

This is the twelfth printing of a book on the selection and heat-treatment of steel for making any kind of tool. It is valuable as a text-book for apprentice training and equally useful as a handbook for toolmakers and tool supervisors. Skilled craftsmen will find many suggestions to aid them. The book explains how to make tools that will last longer, how to get more production with present equipment, and how to reduce unit costs. One chapter is devoted to "Trouble Shooting." This contains helpful suggestions for locating the cause of common troubles in the tool-room and hardening department.

MACHINE DESIGN. By P. H. Hyland and J. B. Kommers. 562 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $4.50.

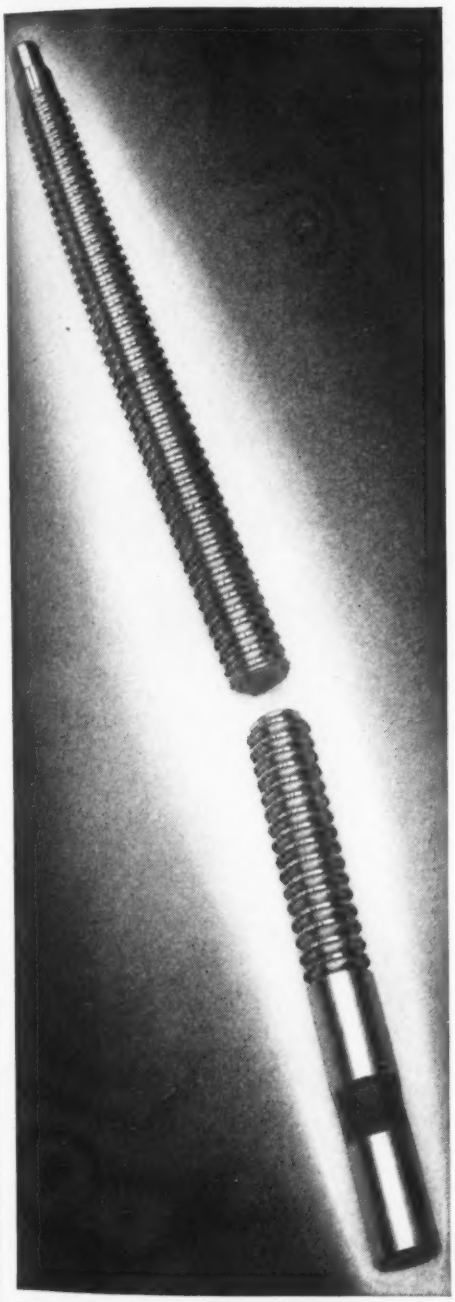
This is the third edition of a book written to serve as a text-book in teaching the elements of machine design. The text covers metal-working and shop processes; materials of construction; linkwork, instant centers, and velocity diagrams; cams; fundamental mechanics; bearings, friction, and lubrication; friction as a useful agent; riveted joints; screw fastenings and power screws; shafting and shaft couplings; keys; toothed gears; design of various machine elements; and machine frames.

CONTROLLING ABSENTEEISM—A Record of War Plant Experience. 57 pages, 6 by 9 inches. Published by the United States Department of Labor, Division of Labor Standards, Washington, D. C., Price, 10 cents.

# Obituaries

W. J. WOOLDRIDGE died at his home near Pittsburgh, Pa., on April 6, at the age of seventy years. Mr. Wooldridge was associated with W. S. Moody, of the General Electric Co. at the Pittsfield, Mass., plant at the time that Mr. Moody was doing pioneer engineering work on silicon steel sheets. He was later connected with a number of producers of silicon sheets, and in 1933 he joined the Allegheny Ludlum Steel Corporation, Brackenridge, Pa., as head of silicon sheet sales, continuing in that capacity until his partial retirement a few years ago.

**2 SECONDS**
*would have saved this broach . . . . .*



*It may take 100 days to get a new one*

*How to get more production with your Broaches------*

## 4. BY PROPER ALIGNMENT

It only takes a second or two to make sure that the piece to be broached is PROPERLY AND SECURELY seated in the fixture.

When parts are not securely seated they may "jump" into place while the broach is moving. If this happens the part tends to "cock" and jam against the broach, frequently resulting in tooth breakage if not breakage of the broach itself.

And, when you are broaching a cored or forged hole from the rough, it is safest to use an equalizing fixture to avoid localized high tooth loads tending to force the broach out of alignment.

For the same reason, a drilled hole should be square with the face or surface of the part against which it is located in the broaching fixture.

Simple precautions such as these will enable you to reduce broach breakage, reduce tool costs, and avoid production tie-ups.

*Write for a copy of "Broaching News" Vol. IV, No. 8 for further details on "How to Get the Most Out of Your Broaches".*

**colonial BROACH COMPANY**

*Broaching Machines* — *Broaches-Broaching Equipment*

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